DOE F 1325.8
(8-89)
EFG (07-90)

United States Government

Department of Energy

(19)

memorandum

DATE: JAN 14 1998

REPLY TO ATTN OF: DOE Oakland Operations Office (ESHD)

SUBJECT: Response to Secretarial Memo of August 4, 1997: Management of Chemical Hazards Vulnerabilities

TO: Peter N. Brush, EH-1
Acting Assistant Secretary
for Environment, Safety and Health

Victor H. Reis, DP-1
Assistant Secretary
for Defense Programs

Alvin L. Alm, EM-1
Assistant Secretary
for Environmental Management

Martha A. Krebs, ER-1
Director, Office of Energy Research

The Oakland Operations Office (OAK) response to chemical safety concerns addressed in Secretary Peña's August 4, 1997 directive is attached. Issues covering Oakland Operations Office programs are all addressed by site office in the attachment's initial table. Issues that address contractor programs are listed in the table but the bulk of contractor responses is contained in contractor reports that are appended to the attachment. This

memo includes responses for Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, Stanford Linear Accelerator Center, and Energy Technology Engineering Center.

Martin J. Dimogole
for James M. Turner, Ph.D.
Manager

Attachments: (1) Table

(2) Letter dated 12/12/97
L. Lynn Cleland, LLNL to
James S. Hirahara, SAN
w/encl

(3) Letter dated 12/22/97
David McGraw, LBNL to
Richard Nolan, SAN w/encl

(4) Letter dated 11/17/97
Jack Hahn, SLAC to
John Muhlestein, SAN w/encl

(5) Letter dated 10/1/97
M. J. Gabler, ETEC to
James M. Turner, SAN w/encl

Site Office	Actions Required	Actions Taken/Status
1) Develop an approval process to assure:	a) The disposal of hazardous chemicals; and,	LLNL Site Office Response • **Hazardous chemical waste is managed in accordance with all applicable waste regulations, documented in LLNL's Health and Safety Manual and Environmental Protection Department/Hazardous Waste Management Division Waste Acceptance Criteria** EM Site Office Response: • **The approval process is documented in:** **- The Environmental Protection Department/Hazardous Waste** • **Management Division Waste Acceptance Criteria, August 1997** **- The HWM Part A Permit, and the Interim Status Document.** SLAC Site Office Response: Hazardous chemical waste is managed by SLAC in accordance with applicable hazardous waste regulations. SLAC has an established infrastructure to manage chemicals from the point of generation to waste disposal. Hazardous waste and Materials Coordinators oversee all aspects of hazardous waste and accumulation within their areas of operation. SLAC's Waste Management Department is responsible for accepting waste from the generators to properly store, package and dispose of the waste to an off-site disposal facility. DOE maintains close coordination with SLAC to ensure proper management and disposal of chemical waste. This is accomplished by operational awareness, monthly program meetings, and annual performance evaluations based on performance measures and the Re-engineering Waste Management Pilot Program quantitative and qualitative measures. LBNL Site Office Response: LBNL's self-assessment found no areas of major concern. Three individual instances of current chemical vulnerability were uncovered, all of a relatively low significance level. An approval process for chemical disposal exists and is conducted in accordance with their Resource Conservation and Recovery Act (RCRA) permit [reference 40 CFR part 270 and California State equivalent 22 CCR 66270]. Radiological waste is disposed of in accordance with DOE Order 5820.2A.

Site Office	Actions Required	Actions Taken/Status
	b) Safe and environmentally compliant storage and handling of retained hazardous chemicals.	LLNL Site Office Response/EM Office Response: • **Retained or recycled chemicals are managed under the Chemical Exchange Warehouse Program (CHEW). The approval process in documented in HWM Procedure 588, Management of CHEW.** • **Retained or recycled chemicals are managed under the Chemical Exchange Warehouse Program (CHEW). The approval process in documented in HWM Procedure 588, Management of CHEW.** SLAC Site Office Response: The Stanford Site Office and SLAC Safety, Health and Assurance Department will conduct joint inspections of all buildings containing chemicals. Locations where Threshold Planning Quantities (TPQ's) of chemicals are stored will get specific approval. All chemical requisitions are reviewed and approved by the SLAC Safety, Health, and Assurance Department and at the time chemical storage requirements will be specified.
2) Reassess known vulnerabilities (chem & rad) at facilities that:	a) Are shutdown	LLNL Site Office Response • **LSO is in the process of investigating the status at shutdown, standby, and deactivated facilities as well as facilities having major mission changes in the past several years.** • Corrective actions for chemical safety vulnerabilities identified by the **Chemical Safety Vulnerability Working Group Report** are tracked by OAK. One worker training issue on cryogenic hazards remains open and continues to be tracked. Others have been tracked to closure.

Site Office	Actions Required	Actions Taken/Status

- The Plutonium Vulnerability Study identified three issues:

  1. Too much Pu on site possibly leading to too much exposure, greater amount of risk etc. in having to manage the material. This is a continuing issue. About five years ago there was a Pu reduction program which collapsed after no other place in the DOE complex would accept Pu which is where things remain today. Until DOE comes up with place meant to take and deal with excess plutonium, we will continue to store it.

  2. Pu onsite needs to be re-packaged. This a continuing issue and a duplicate finding to DNFSB recommendation 94-1. Currently we are still in the contracting process for a new design of container/packaging system. Re-packaging should start some time after April 1998.

  3. Wall inside Pu facility may not be seismically safe and could affect Pu stored nearby. Status - corrected.

- The Highly Enriched Uranium Vulnerability Study recommended that LLNL should undertake a study to determine exposure risk presented from HEU on site. No action is currently planned on this issue.

Site Office	Actions Required	Actions Taken/Status
		SLAC **Site Office Response:** There are no known chemical vulnerabilities in shut down SLAC facilities. A wall to wall walk-through of all SLAC facilities is just being completed by SLAC Safety, Health and Assurance Department Industrial Hygienists. No such vulnerabilities were identified during the Chemical Safety Working Group Facility selection process in 1994. The quality of the SLAC Walk-through is evaluated during contractual performance assessments. LBNL Site Office Response: Two facilities qualify in this category. There are no major quantities of chemicals in storage. There are some minor vulnerability issues, which are being addressed. The Site Office is working with LBNL to develop specific abatement actions and timetables for these facilities.
	b) Are in standby	LLNL Site Office Response • **The Site Office is in the process of investigating the status at shutdown, standby, and deactivated facilities as well as facilities having major mission changes in the past several years.** • **Also, the Site Office has requested LLNL provide a status report on any outstanding evaluations on standby facilities for DOE/OAK.** SLAC Site Office Response: There are no known chemical vulnerabilities at SLAC facilities that are in standby. A wall to wall walk-through of all SLAC facilities is just being completed by SLAC Safety, Health and Assurance Department Industrial Hygienists. No such vulnerabilities were identified during the Chemical Safety Working Group Facility selection process in 1994. The quality of the SLAC Walk-through is evaluated during contractual performance assessments.

Site Office	Actions Required	Actions Taken/Status
	c) Are being deactivated	LLNL Site Office Response • **The Site Office is in the process of investigating the status of deactivated facilities under its cognizance for any chemical or radiological vulnerabilities.** • **All other vulnerabilities are listed below in the EM response.** EM Site Office Response: • **B419 is undergoing RCRA closure. The only known vulnerabilities are fixed RCRA level chemical and rad contamination. Extensive sampling and analysis is performed to characterize the contaminates and levels. This activity is covered by in Operational Safety Procedure (OSP) that was recently reviewed.** • **Vulnerabilities related to deactivation, closure, or operational changes are assessed in accordance with DOE Order 5480.21, Unreviewed Safety Questions, as implemented by the Health & Safety Manual Supplement 2.21, "Implementation Guide for the Unresolved Safety Question Process".** SLAC Site Office Response: There are no known chemical vulnerabilities at SLAC facilities that are being deactivated. A wall to wall walk-through of all SLAC facilities is just being completed by SLAC Safety, Health and Assurance Department Industrial Hygienists. No such vulnerabilities were identified during the Chemical Safety Working Group Facility selection process in 1994. The quality of the SLAC Walk-through is evaluated during contractual performance assessments.
	d) Have otherwise changed their conventional mode of operation in the past several years	LLNL Site Office Response • **There are no known chemical or radiological vulnerabilities at facilities having major mission changes in the past several years. However the Site Office is in the process of walk-throughs that will update any recent changes.**

Site Office	Actions Required	Actions Taken/Status
		SLAC Site Office Response: There are no known chemical vulnerabilities at SLAC facilities that have changed their mission. A wall to wall walk-through of all SLAC facilities is just being completed by SLAC Safety, Health and Assurance Department Industrial Hygienists. No such vulnerabilities were identified during the Chemical Safety Working Group Facility selection process in 1994. The quality of the SLAC Walk-through is evaluated during contractual performance assessments.
3) Assess the technical competence of their staff to recognize the full range of hazards presented by the materials in their facilities and implement training programs where needed.	a)Who is doing chemical safety hazard recognition?	LLNL Site Office Response • **Program Facility Representatives (FRs) conduct assessments with ESHD assistance when requested.** • **The Site Office does assessments with ESHD assistance when requested.** EM Office Response: • **HWM's Chemists on the Characterization Chemistry Team (all with at least bachelor degrees in chemistry).** SLAC Site Office Response SLAC Personnel: Joe Kinney Jim Scott Jack Fry Ih Linn John Shepardson Valerie Stone SSO Personnel Hanley Lee Martin Molloy Harvey Grasso

Site Office	Actions Required	Actions Taken/Status
		LBNL Site Office Response: Training programs are in place, including reviews to determine training needs. For the Hazardous Waste Handling Facility, federally-mandated training (RCRA Part B), as well as local training in hazardous waste operations, hazardous waste sampling and emergency response. Certain workers also receive Department of Transportation (DOT) packaging and transportation training. The Site Office appraised LBNL's training program in October 1996 and November 1997; implementation of corrective actions is presently ongoing.
	b) What training qualifies the above persons to identify chemical safety hazards:	SLAC Site Office Response SLAC Personnel Joe Kinney: Jim Scott: Jack Fry: Ih Linn: Certified Industrial Hygienist John Shepardson: M.S. Industrial Hygiene Valerie Stone: M.S. Industrial Hygiene SSO Personnel Hanley Lee, BS Mechanical Engineer Martin Molloy: Phd Physics Harvey Grasso: BS Chemical Engineering; Certified Industrial Hygienist; DOE Process Safety Management Course
	i) Toxic materials;	LLNL Site Office Response • **Facility Representatives (FR) have either engineering or physical science degrees. They take basic Toxicology or Industrial Hygiene courses, and half-day courses in Hazard Communication and Chemical Safety to have a familiarity level of knowledge in chemical hazards.** • **ESHD has staff Certified Industrial Hygienist(CIH) with chemical process safety management training, and chemical engineering degree to assist FRs.**

Site Office	Actions Required	Actions Taken/Status
		EM Office Response: • **Educational background and required training as documented in the HWM Training Implementation Matrix..**
	ii) Corrosive materials;	LLNL Site Office Response • **FRs have either engineering or physical science degrees. They take basic Toxicology or Industrial Hygiene courses, and half-day courses in Hazard Communication and Chemical Safety to have a familiarity level of knowledge in chemical hazards.** • **ESHD has staff CIH with chemical process safety management training, and chemical engineering degree to assist FRs.**
	iii) Reactive materials;	LLNL Site Office Response • **FRs have either engineering or physical science degrees. They take basic Toxicology or Industrial Hygiene courses, and half-day courses in Hazard Communication and Chemical Safety to have a familiarity level of knowledge in chemical hazards.** • **ESHD has staff CIH with chemical process safety management training, and chemical engineering degree to assist FRs.**
	iv) Explosive materials?	LLNL Site Office Response • **FRs have either engineering or physical science degrees. They take basic Toxicology or Industrial Hygiene courses, and half-day courses in Hazard Communication and Chemical Safety to have a familiarity level of knowledge in chemical hazards.** • **ESHD has staff CIH with chemical process safety management training, and chemical engineering degree to assist FRs**
	c) What training is being planned to improve worker qualifications?	LLNL Site Office Response • **FRs and ESHD staff are trained in accordance with their Technical Qualification Programs.** • **Additional training, if required, will be discussed in the upcoming meetings.**

Site Office	Actions Required	Actions Taken/Status
		EM Office Response: • **Refresher courses in accordance with HWM Training Implementation Matrix are conducted routinely** • **There are no plans for modifying worker training specifically related to the topic of chemical safety hazards. All of the training is being reviewed at this time, as part of the response to a Judgment of Needs, to identify gaps in the current training program. Initial focus will be on radiological worker and respiratory protection training. This assessment should be complete by Spring, 1998.**
4) Assess site Lessons Learned and Occurrence Reporting programs to assure that :	(a) Outgoing information is:	
	i) Well characterized;	LLNL Site Office Response • **LSO has not officially assessed the LLNL Lessons Learned Program for Chemical Hazards and is planning to discuss with other Programs in the upcoming meetings.** • **LSO evaluated the DOE/OAK ORPS Program and LLNL ORPS Program during the 1996 Appraisal in November 1996. Over the past year, backlogs and the quality of occurrence reports (ORs) have improved.** • **The outgoing information is considered well characterized.** EM Office Response: • **LLNL Lessons Learned notices are distributed to group leaders and employees, and posted on HWM safety bulletin boards.** • **The LLNL Implementing Procedure for Occurrence Reporting and Processing of Operations Information is used by HWM for processing information for Occurrences. HWM has a designated responsible person for entering, updating, and maintaining the Occurrence Reports for HWM. After HWM management reviews and concurrence, reports are forwarded to the Assurance Manager's Office of the Environmental Protection Department. There is an approval protocol that is followed when Reports are submitted to the LLNL Occurrence Reporting Office from the EPD Assurance Manager's Office.**

Site Office	Actions Required	Actions Taken/Status
		SLAC **Site Office Response:** The Stanford Site Office will evaluate SLAC's ORPS and Lessons Learned Programs to ensure outgoing information is well characterize and summarized. LBNL Site Office Response: BSO appraised LBNL's Lessons Learned program in October 1996. No major deficiencies were noted. Both LBNL and DOE Oakland Operations Office review and distribute lessons-learned. BSO appraised LBNL's Occurrence Reporting system in November 1997. No major deficiencies were noted.
	ii) Properly summarized;	LLNL Site Office Response • **LSO has not officially assessed the LLNL Lessons Learned Program for Chemical Hazards and is planning to discuss with other Programs in the upcoming meetings.** • **LSO evaluated the DOE/OAK ORPS Program and LLNL ORPS Program during the 1996 Appraisal in November 1996. Over the past year, backlogs and the quality of occurrence reports (ORs) have improved.** • **The outgoing information is considered properly summarized.** SLAC Site Office Response The Stanford Site Office will determine the extent SLAC is disseminating, evaluating, and implementing incoming information that could have application to SLAC operations and activities.
	(b) Incoming information is i) Thoroughly evaluated;	LLNL Site Office Response • **The Site Office will assess the LLNL Lessons Learned Program for Chemical Hazards in upcoming assessments.** • **LSO evaluated the DOE/OAK ORPS Program and LLNL ORPS Program during the 1996 Appraisal in November 1996. Over the past year, backlogs and the quality of occurrence reports (ORs) have improved.**

Site Office	Actions Required	Actions Taken/Status
		• **The incoming information is received and distributed by DOE ORPS Manager at LLNL and thoroughly evaluated by the assigned Subject Matter Expert (SME).**
	ii) Properly disseminated;	LLNL Site Office Response • **LSO will assess the LLNL Lessons Learned Program for Chemical Hazards in this area during upcoming assessments.** • **LSO evaluated the DOE/OAK ORPS Program and LLNL ORPS Program during the 1996 Appraisal in November 1996. Over the past year, backlogs and the quality of occurrence reports (ORs) have improved.** • **Currently, DOE ORPS Manager at LLNL confers with LLNL ORPS Manager daily, assigns ORs to SME, reviews the status, and develops trends.**
	iii) Appropriately implemented; and	LLNL Site Office Response • **LSO will assess the LLNL Lessons Learned Program for Chemical Hazards in this area during upcoming assessments.** • **LSO evaluated the DOE/OAK ORPS Program and LLNL ORPS Program during the 1996 Appraisal in November 1996. Over the past year, backlogs and the quality of occurrence reports (ORs) have improved.** • **Currently, DOE ORPS Manager at LLNL confers with LLNL ORPS Manager daily, assigns ORs to SME, reviews the status, and develops trends.**
	iv) Tracked through ormal management systems.	LLNL Site Office Response • **LSO will assess the LLNL Lessons Learned Program for Chemical Hazards in this area during upcoming assessments.** • **LSO evaluated the DOE/OAK ORPS Program and LLNL ORPS Program during the 1996 Appraisal in November 1996. Over the past year, backlogs and the quality of occurrence reports (ORs) have improved.** • **Currently, DOE ORPS Manager at LLNL confers with LLNL ORPS Manager daily, assigns ORs to SME, reviews the status, and develops trends.**

Contractors, with DOE assistance, as appropriate, will:		ACTIONS TAKEN/STATUS
1) Scrutinize their	a) Use and storage of any chemicals that have the potential for explosion, fire, or significant toxic release,	LLNL Site Response: See attached LLNL letter dated December 12,1997 Subject: Management of Chemical Hazards: LLNL Status update. EM Office response **The Environmental Protection Department/Hazardous Waste Management Division Waste Acceptance Criteria, August 1997** • **The HWM Part A Permit, and the Interim Status Document.** • **Implementation of DOE Order 5480.23, Nuclear Safety Analysis Reports, DOE Order 5480.22, Technical Safety Requirements, DOE Order 5480.21, Unreviewed Safety Questions, DOE Order 5481.1B, Safety Analysis and Review Systems.** • **Facility Safety Procedures, Operational Safety Procedures, Standard Operating Procedures, Hazard Assessments** SLAC Site Response: See attached SLAC letter dated November 17,1997 Subject: Management of Chemical Hazards. ETEC Site Response: See attached Boeing letter dated October 1,1997 Subject: Management of Chemical Hazards. LBNL Site Response: See attached LBNL letter dated December 20,1997 Subject: Management of Chemical Hazards.
	b) Proper disposal of unneeded chemicals in accordance with safety requirements and	LLNL Site Response: See attached LLNL letter dated December 12,1997 Subject: Management of Chemical Hazards: LLNL

Contractors, with DOE assistance, as appropriate, will:	ACTIONS TAKEN/STATUS
environmental regulations.	Status update. EM Office response: • **The Environmental Protection Department/Hazardous Waste Management Division Waste Acceptance Criteria, August 1997** • **The HWM Part A Permit, and the Interim Status Document.** • **Retained or recycled chemicals are managed under the Chemical Exchange Warehouse Program (CHEW). The approval process in documented in HWM Procedure 588, Management of CHEW.** SLAC Site Response: See attached SLAC letter dated November 17,1997 Subject: Management of Chemical Hazards. ETEC Site Response: See attached Boeing letter dated October 1,1997 Subject: Management of Chemical Hazards. LBNL Site Response: See attached LBNL letter dated December 20,1997 Subject: Management of Chemical Hazards.

Contractors, with DOE assistance, as appropriate, will:	ACTIONS TAKEN/STATUS
2) Evaluate their facilities and operations for new vulnerabilities on a continuing basis.	LLNL Site Response: See attached LLNL letter dated December 12,1997 Subject: Management of Chemical Hazards: LLNL Status update. EM Office response • **DOE Order 5480.21, Unreviewed Safety Questions, as implemented by the Health & Safety Manual Supplement 2.21, "Implementation Guide for the Unresolved Safety Question Process".** SLAC Site Response: See attached SLAC letter dated November 17,1997 Subject: Management of Chemical Hazards. ETEC Site Response: See attached Boeing letter dated October 1,1997 Subject: Management of Chemical Hazards. LBNL Site Response: See attached LBNL letter dated December 20,1997 Subject: Management of Chemical Hazards.
3) Assess the technical competence of their staff to recognize the full range of hazards presented by the materials in their facilities and implement training programs where needed.	LLNL Site Response: See attached LLNL letter dated December 12,1997 Subject: Management of Chemical Hazards: LLNL Status update. SLAC Site Response: See attached SLAC letter dated November 17,1997 Subject: Management of Chemical Hazards. ETEC Site Response: See attached Boeing letter dated October 1,1997 Subject: Management of Chemical Hazards. LBNL Site Response: See attached LBNL letter dated December 20,1997 Subject: Management of Chemical Hazards.

Lawrence Livermore National Laboratory

Laboratory Site Operations

December 12, 1997

Mr. James S. Hirahara
Associate Manager for Site Management
Oakland Operations Office
U.S. Department of Energy
1301 Clay Street
Oakland, CA 94612-5208

Subject: Management of Chemical Hazards: LLNL Status Update

References: 1. Letter Hirahara (October 7, 1997) to Cleland, Management of Chemical Hazards
2. Letter Pena (August 4, 1997) to Program Secretarial Officers and Field Element Managers, DOE Response to the May 14, 1997 Explosion at Hanford's Plutonium Reclamation Facility

Dear Mr. Hirahara,

Attached is Lawrence Livermore National Laboratory's response to the above referenced letters. This report describes the specific actions taken and the improvements made to our chemical safety program since we submitted the "Chemical Safety Vulnerability Comprehensive Site Response Plan," in September 1995.

We believe that the ongoing processes discussed in these reports adequately identify and reduce the potential for significant reactive and explosive chemical hazards.

Please contact Jerry Schweickert (422-5267) if you have any questions or need further information about this topic.

Sincerely,

L. Lynn Cleland
Laboratory Site Manager

LLC:jar
Attachment
cc: Ray Corey
Dennis K. Fisher
Robert W. Kuckuck
C. Bruce Tarter
James M. Turner

Management of Chemical Hazards: LLNL Status Update

December 12, 1997

Introduction

In August 1997, Secretary Pena directed LLNL to perform three actions:

- Scrutinize use and storage of chemicals with the potential for explosion, fire, or significant toxic release.
- Evaluate facilities and operations for new vulnerabilities on an ongoing basis.
- Assess staff's technical competence to recognize hazards; train where needed.

This report updates LLNL's management of chemical hazards. Our September 1995 report, "Chemical Safety Vulnerability Comprehensive Site Response Plan," is attached for reference.

Line management, which has responsibility for safety, conducted this review. Each Directorate was told the purpose of this assessment and provided with background information about potential situations and materials of concern. Guidance for resolving potential problems was given, and technical support was offered from the ES&H Teams, Hazardous Waste Management, and Chemistry and Materials Science.

1.0 Scrutinize use and storage of chemicals with the potential for explosion, fire, or significant toxic release

In late Fall 1997 an extensive field survey was completed. This was in addition to the recent wall-to-wall annual inventory conducted by ChemTrack. (ChemTrack operations are described in Section 2.1, and the attachment.)

All buildings and trailers were reviewed. Chemical and location data on 389 buildings and trailers from the current ChemTrack database was sent to the twelve Assurance Managers representing each LLNL Directorate. Further instructions were given to include transportainers, mothballed areas, and lesser traveled storage spaces for missing chemical containers. These were evaluated in light of Secretary Pena's request with emphasis on:

- Chemicals of concern, which were to be evaluated on a prioritized basis. These included materials which are unstable, reactive, or have a limited shelf-life.
- Shut-down or inactive operations including process hardware (e.g., tubing, ductwork, reaction vessel, or storage tank), or activities where the responsible worker was transferred or has terminated employment.

- A triage approach, shown in the Appendix, was used as an aid for identifying situations, materials, and conditions of concern.

A related activity, the ChemTrack reconciliation process, began as scheduled in December 1997 and is to be completed in the first quarter of 1998. This is a quality assurance review conducted by facility and program staff to clarify ownership of chemical containers, find missing items, and delete empty containers from the database. This simultaneous process was beneficial in that it promoted additional awareness to identifying container contents and examining potential storage issues.

- **RESULTS:**

All directorates have substantially completed their surveys and are managing any identified issues. Two areas are verifying the results of their initial reviews to assure that the survey was adequately conducted. Their final conclusions are due at the end of January 1998.

No significant issues were discovered. As a result of this review, several minor chemical safety deficiencies involving small quantities were observed. These were corrected when found, or are in the process of being evaluated and corrected. Those issues identified which have not been totally resolved will be entered into the Deficiency Tracking System to ensure follow-up monitoring to completion. Typical examples are shown below.

Specific deficiencies	Resolution
Misplaced chemicals were found in a transportainer (gram quantities)	Containers moved to a laboratory and entered into ChemTrack
Storage cabinet of chemicals in reagent-sized containers was not included in ChemTrack inventory. Some materials were old and potentially degrading. Incompatible materials were stored together.	Containers evaluated on a case basis. Some will be retained, others will be processed as hazardous waste. ChemTrack inventory updated.
Can of gasoline improperly stored.	Container moved to a flammable storage cabinet.
Chemicals (reagent quantities) found which have exceeded their suggested shelf life.	a. Some chemicals will be processed as hazardous waste. b. Some chemicals will be tested for contaminants and either retained or disposed.

2.0 Evaluate facilities and operations for new vulnerabilities on an ongoing basis

Prior to the Secretary's directive, we had an ongoing program for identification and resolution of chemical hazards and related issues. The September 1995 report describes this program in detail. Highlights of the enhancements made since then are summarized below.

- The ChemTrack program has matured; data quality is higher, and the capability to generate reports is used regularly.
- Planning requirements and responsibilities for surveillance of shutdown facilities and operations have been updated.
- Additional guidance on the Deficiency Tracking and Self-Assessment programs has been published in the LLNL *Health & Safety Manual.*

Further information about these and other changes is provided in the remainder of Section 2.

2.1 Chemical Inventory and Management System (ChemTrack)

ChemTrack is the Laboratory's computerized chemical tracking system, designed to meet Community Right-to-Know regulatory requirements and improve the management of hazardous materials. ChemTrack utilizes bar codes, laser scanners, and customized computer software to inventory and track chemical containers site-wide.

First implemented in 1993, the ChemTrack system continues to expand functionality as software and data quality improve. New portable inventory scanners are improving the efficiency of tracking approximately 150,000 chemical containers at LLNL; storage locations and container owner information are updated at least once a year. The correct assignment of chemical abstract service numbers to all pure chemicals in ChemTrack now allows new reporting functions based on established regulatory chemical lists that have been pre-loaded into the system. For example, chemicals regulated by the International Agency for Research on Cancer (IARC) and OSHA can now be identified in the inventory, as well as those regulated by California Proposition 65.

LLNL's procurement process now includes a provision for electronic notification to ChemTrack of chemical purchases made via the Laboratory's Total On-Line Procurement System (TOPS), including credit card and blanket release transactions. This provides more effective management of chemical safety concerns before the items arrive on site.

ChemTrack is actively pursuing the development of a Web-based user interface to allow broader employee access to chemical inventory data. This interface—expected to be operational in FY 98—will greatly expand the system's utility for inventory management, chemical sharing, and emergency response.

2.1.1 Explosives Inventory and Surveillance Program

Magazine storage of explosive materials (including propellants) is tracked using a separate system maintained by the Materials Management Section. This database records the materials on hand their quantity, owner, and next stability review date (when applicable). The inventory is updated each time an item is moved to a different location.

2.2 Self-Assessment Program

This program is described in various documents. The policies and procedures for conducting these assessments were updated and published in *Health & Safety Manual* Supplement 2.04, "Directorate ES&H Self-Assessment Program" on April 18, 1997. Laboratory policy requires that each directorate develop and conduct its own ES&H Self-Assessment Program. Directorates use their staff, ES&H Team members, or independent external organizations (e.g., ICF Kaiser Engineers) to perform these assessments. An annual status report is prepared and submitted to the Associate Director for review.

The Assurance Review Office and the ES&H Working Group prepare an annual list of focus areas to direct the scope of all self-assessments. The 1997 list included a review of directorate Chemical Hygiene Plan implementation at all applicable levels and hazardous waste accumulation areas.

The Self-Assessment Program is in addition to normal oversight of chemical handling operations provided by management and ES&H support staff walk-throughs.

2.3 Deficiency Tracking System (DefTrack)

The Laboratory maintains a Deficiency Tracking System (DefTrack) which is used by all directorates to record and track the status of environmental, safety, and health deficiencies. The DefTrack database is also used to document formal self-assessment activities in which no deficiencies are discovered.

DefTrack provides a mechanism for monitoring chemical safety issues that, once discovered, may not be resolved on the spot. The system requires that the item be evaluated and assigned a priority for corrective action and identifies the person responsible for ensuring completion of the corrective action. A summary of items entered into DefTrack is submitted to the

responsible Associate Director as part of the annual self-assessment status report.

An overview of the DefTrack system was published in *Health & Safety Manual* Supplement 2.03, "Environmental, Safety, and Health Deficiency Tracking System," on August 26, 1997. Detailed information is provided in the *DefTrack User Manual* and the *DefTrack System Maintenance Manual,* which are maintained by the Assurance Review Office.

2.4 Other Updated Information and Guidance

- ***Health & Safety Manual* Chapters and Supplements**

Chapter 21, Section 21.055 Peroxidizable Materials

Supplement 2.10, Guidelines for the Shutdown or Transfer of Operations or Buildings.

Supplement 2.30 Guid. .ines for Decontamination and Disposition of Process-Contaminated Facilities and Associated Equipment.

- **Environmental Protection Pulications**

Guidelines for Retention Tank Systems
Spill Prevention Control and Countermeasure
Waste Acceptance Criteria, Rev. 1

- **Material Safety Data Sheets (MSDSs)**

On-line access to MSDSs is now possible over the internal LLNL-only web.

2.5 Recent Results

Our ongoing surveillance periodically uncovers the existance of potential hazards needing attention. Following are some issues from recent months.

- A large quantity of propellants had an insufficient level of stabilizers. As the material was no longer needed for mission work, it was burned.

- Exhaust ventilation system ductwork was being disassembled as part of a re-roofing job. A routine sample for the presence of perchlorate salts was positive. Work was suspended until additional guidance on safe work procedures was available.

- A walkthrough of an inactive building revealed an in-place system that formerly contained reactive gas. Pressure system inventory records identified the former operator who assigned workers to dismantle the system. The system had been purged when the operation was terminated.

3. 0 Assess staff's technical competence to recognize hazards; train where needed

For this review, specific training sessions were held with some building coordinators and other individuals with assessment responsibilities. The purpose of the survey was described and precautions about handling containers of unknown contents, should they be encountered, were discussed. Inviduals were cautioned to contact the program responsible person or their ES&H Team for guidance and assistance.

In the course of their duties, the ChemTrack inventory team may encounter unique chemical storage situations. They have received specialized training on hazard recognition and precautions.

The LLNL training program was described in the September 1995 report (see attachment). Since then chemical safety training efforts have been expanded and made more accessible.

- Different chemical safety and hazard communication courses are offered for research laboratory workers and general audiences.
- Computer-based and web-based courses have been developed to fit the workforce's scheduling needs.
- Just-in-time training is used as needed for special situations.

A major new tool for determining training needs, LTRAIN, was launched in mid-1997. This is an interactive questionnaire that each employee completes about his/her job duties. The information is compared with a training requirements database which prepares a training profile for the employee. Supervisors and Directorate training managers then determine whether additional training needs exist.

One of the 1997 Self-Assessment focus items is a training implementation review. This is to assure that a Directorate-level assessment is examining the ES&H training needs of workers and determining whether these needs are being met such that employees are qualified for their work.

Appendix

Procedure for Recognizing Potential Hazardous Material Problems

Situations of Concern	Materials of Concern	Conditions of Concern
If any of these are present:	Then look for these types of materials (see attached lists):	Report or investigate further when these are observed:
• Long-term unattended space • Lab or shop close-out or transfer • Areas not inspected recently (e.g., freezers, refrigerators, and transportainers) • ChemTrack survey found large numbers of unbarcoded containers • Former process hardware with high hazard materials	Corrosive gases Strong oxidizers Peroxidizable compounds Perchlorates Reactive metals Picric acid Hydrogen peroxide >35% Permanganates	Exposure to sun, temperature, or rain Missing labels Crystallization, external surfaces* Discoloration Concentration or loss of weight Evaporation to dryness or sediment* Containers not intact Flammable, reactive materials with combustible packaging (cardboard) Expired shelf life*

* CAUTION! Do not touch without further evaluation.

Attachment

Lawrence Livermore National Laboratory, Chemical Safety Vulnerability Comprehensive Site Response Plan, September 1995

Attachment

Lawrence Livermore National Laboratory, Chemical Safety Vulnerability Comprehensive Site Response Plan, September 1995

Lawrence Livermore National Laboratory

September 22, 1995

Mr. Edward M. Ballard, Acting Director
Environment, Safety & Facilities Operations Division
U.S. Department of Energy
San Francisco Operations Office
1301 Clay Street
Oakland, CA 94612-5208

Subject: Chemical Safety Vulnerability - LLNL Comprehensive Site Response Plan

Reference: Letter Ballard (September 5, 1995) to Fisher, (Guidance for Comprehensive Site Response Plan Preparation)

Dear Mr. Ballard:

Enclosed please find Lawrence Livermore National Laboratory's Comprehensive Site Response Plan which has been prepared in response to the Department of Energy Chemical Safety Vulnerability Review, Management Response Plan, Task 2. This plan was prepared based on the provided guidance document developed by the DOE Action Team and includes an assessment of the LLNL chemical safety systems against each of the eight identified vulnerabilities.

Overall, our assessments indicate that LLNL has effectively reduced the identified potential chemical safety vulnerabilities through our chemical safety systems to acceptable levels. There are ongoing management actions, described in the enclosed plan, which are expected to further minimize potential vulnerabilities.

Please feel free to contact my office or Rex Beach (510-422-7592) if you have any questions or need further information.

Sincerely,

Dennis K. Fisher
Associate Director
Plant Operations

JRM:DenFisher-Chem Vulner

LAWRENCE LIVERMORE NATIONAL LABORATORY

CHEMICAL SAFETY VULNERABILITY COMPREHENSIVE SITE RESPONSE PLAN

September 1995

Introduction

A chemical safety vulnerability review of the DOE complex was conducted between February and July 1994 at the request of the Secretary of Energy. This review resulted in the identification of the following eight generic vulnerabilities that were considered symptomatic of weaknesses in safety management systems to adequately address chemical hazards throughout their life cycle:

- Abandoned chemicals and chemical residuals
- Past chemical spills and ground releases
- Characterization of legacy chemicals and wastes
- Disposition of legacy chemicals
- Storage facilities and conditions
- Condition of facilities and support systems
- Unanalyzed and unaddressed hazards
- Inventory control and tracking

The Chemical Safety Vulnerability Management Response Plan (dated September 1994), stated that " ..all DOE sites that maintain chemical operations, storage facilities, or 'legacy' chemical holdings will assess their status with respect to the eight generic vulnerabilities identified by the Chemical Safety Vulnerability Working Group and will identify any vulnerabilities not currently controlled under their environment, safety, and health (ES&H) programs. The sites will then prepare comprehensive site response plans to report their vulnerabilities and to address those vulnerabilities requiring mitigation to comply with regulations, standards and DOE Directives."

This report presents the Lawrence Livermore National Laboratory (LLNL) Comprehensive Site Response Plan including an assessment on each of the eight identified vulnerabilities and planned mitigation actions, where necessary.

The LLNL site response plan is organized as follows:

- Summary of Chemical Management Systems

    1. Chemical Inventory and Management System
    2. Hazards Assessment and Safety Analysis Program
    3. Industrial Hygiene Programs
    4. Industrial Safety Program
    5. Fire Protection Program
    6. Training Program
    7. Hazardous Waste Management
    8. General Chemical Safety Programs

- Eight generic vulnerabilities - each with a determination assessment for LLNL

SUMMARY OF CHEMICAL SAFETY MANAGEMENT SYSTEMS

Existing safety management systems which facilitate control of chemical hazards are summarized in this section. This provides an overview of LLNL's management systems and programs that are being used to promote chemical safety and responsible chemical management throughout the chemical life cycle, including receipt, transport, storage, use, and disposal. These chemical management systems are part of the implementation of the Laboratory's Health and Safety (H&S) Policy; "The LLNL H&S policy is to take every reasonable precaution in the performance of its work to protect the health and safety of employees and the public and to prevent property damage. Furthermore, it is the policy of LLNL to implement U.S. Department of Energy (DOE) H&S orders and comply with prescribed standards and local, state, federal and University of California (UC) regulations in the area of health and safety."

The process of evaluating, planning, integrating and documenting the various elements of the LLNL ES&H Program into experiments, operations, jobs, and projects performed by the Laboratory is described in Chapter 2 of the LLNL *Health & Safety (H&S) Manual*, "Integrating ES&H Into Laboratory Activities". Each step of the life cycle for all work activities is addressed including conception, design/plan, production/procurement, operations and termination/disposal. The integration of ES&H issues for each of these phases is described independent of the size of the work activity. This is similar to the "Plan, Do, Check, Act" cycle of Total Quality Management (TQM), with expanded details in the planning and preparation phase.

ES&H effort required for work performed at LLNL is adjusted using a graded approach. This graded approach involves assessing the hazard(s) (i.e., the danger inherent in an activity) and managing the residual risk (i.e., the danger remaining after controls have been implemented). The greater the risk, the greater the level of control required to manage it. Although different activities demonstrate varying degrees of hazard, all operations are managed such that they present a low risk to employees and the public.

1. Chemical Inventory and Management System

ChemTrack is a computerized chemical tracking system designed to comply with regulatory requirements and improve the way hazardous materials are inventoried and managed at LLNL. ChemTrack utilizes bar codes, laser scanners, and customized computer software to inventory and track chemical containers site-wide.

The system was first implemented in late 1993 with a Laboratory-wide baseline inventory effort and continues to develop in order to address a broad range of institutional needs. The system currently contains inventory information on over 200,000 chemical containers stored at LLNL. Newly purchased chemicals are bar coded and entered into ChemTrack as they arrive on-site and chemical user's are requested to return bar codes for scanning out of the system when the container is ready for disposal. To date, user cooperation with these procedures has been good. These activities, combined with an annual site-wide inventory to recalibrate the system, have resulted in a more accurate inventory and improved compliance. Access to the ChemTrack database is gradually broadening as the system matures to include personnel from the Hazards Control Department and various program organizations.

ChemTrack is used to support a range of ES&H activities, including regulatory reporting under the Superfund Amendments and Reauthorization Act (SARA), improving access to Material Safety Data Sheet (MSDS) and related chemical safety information, assisting in preliminary

hazard assessments of selected LLNL facilities, tracking specified air pollutants, and facilitating informal chemical sharing and pollution prevention initiatives among Laboratory programs. ChemTrack, by providing a more accurate chemical inventory, allows the Laboratory to reduce chemical purchases, more accurately account for and manage legacy chemicals and minimize the generation of hazardous waste.

In the future, ChemTrack will find increasing application in the areas of industrial hygiene (e.g. tracking chemical expiration dates, carcinogens, etc.) and improving emergency response capabilities.

2. Hazards Assessment and Safety Analysis Program

This program provides hazard classifications for Laboratory facilities, and assists Laboratory line and program organizations in preparing and reviewing safety analysis documents required by DOE Orders 5481.1B, 5480.5, 5480.23 and associated DOE standards. Hazard assessments and safety analysis reporting is a performance measure under the University of California (UC) Contract as Criterion 4.1, Performance Measure 4.1.a. This performance measure is assessed annually to ensure continual safety analysis program improvement based on a detailed milestone schedule.

Program and line organizations with hazard ranked facilities are responsible for preparing safety analysis documentation. The Hazards Control Department performs the following functions relating to this program:

- Generates, documents and maintains a hazard assessment and classification for each facility that accurately reflects its current operations and inventory of hazardous and/or radioactive materials.
- Notifies the Associate Director for Plant Operations of any changes in the classification of a facility.
- Issues guidance for the preparation, review and approval of safety analysis documents.
- Prepares the analysis of credible accidents in hazard-ranked facilities, when requested by the programs.
- Provides an independent technical review of Safety Analysis Reports (SARs) generated by the programs.

Safety Analysis: In each Directorate, the following Safety Analysis program elements apply to chemical safety.

The initial step of a safety analysis is a screening to determine, through visiting with the facility personnel, building walk-throughs, and ChemTrack, the amount of hazardous or radioactive materials present. Where Facility or Operational Safety Procedures allow larger quantities than are actually present, the larger quantities are used. This information is then compared to published lists of hazardous materials. If the quantities are available in amounts greater than thresholds given in the tables, a hazard classification is assigned.

The next step in the process is a Preliminary Hazard Analysis (PHA). At this point, worst case accident scenarios are developed and studied to determine on- and off-site effects. Mitigating effects of passive barriers such as the siting, building structure, etc., may be considered. Where

accidents may have significant on-site, but negligible off-site effects, the facility is classified as Low Hazard. If off-site effects are minor but not negligible, the classification is Moderate Hazard. Major off-site effects require a High Hazard classification.

Safety Analysis Reports (SAR) are required for all hazard rank facilities in accordance with DOE Order 5481.1B. The purpose of the report is to show how the risk of the existing hazards are mitigated to an acceptable level by the facility and its operation. Active features that have a mitigating affect on the results of the worst-case accident must be in place whenever the facility is operating. The SAR is the envelope for the facility operations. Operational changes must be compared in the SAR to see if the change leads to new credible accidents not covered in the original analysis and the SAR must be rewritten if accidents are not covered.

3. Industrial Hygiene Programs

The Industrial Hygiene Program is designed to protect the health and safety of employees from biological, chemical and physical hazards. The program is intended to meet requirements in DOE Orders 5480.8A, 5480.10, 5483.1B, 5484.1, and OSHA regulations 29 CFR 1910 and 1926. The program is implemented in all facilities with the above-mentioned hazards. Laboratory guidance is provided in several chapters and supplements of the *H&S Manual*. The principal activities in this program are to:

- Evaluate operations and recommend controls for the safe use and handling of hazardous chemical and biological materials, including carcinogens, mutagens, teratogens and blood borne pathogens.
- Inform the Laboratory's Health Services Department of employees who may need medical monitoring related to potential exposure to health hazards.
- Evaluate the need for and use of respiratory and personal protective equipment, as required.
- Inspect and test laboratory hoods, HEPA filters and other ventilation systems.
- Recommend controls to reduce exposure to noise, and abnormal environmental pressure, humidity and temperature, and to maintain an acceptable level of indoor air quality.
- Recommend controls to protect employees from non-ionizing radiation, e.g. radiofrequency and magnetic fields.
- Inform employees of the health and physical hazards in the workplace and maintain appropriate Material Safety Data Sheets.
- Train employees in recognizing and controlling health and physical hazards in the workplace.
- Establish criteria for sanitary conditions in all facilities, including food service, storage and display areas, and in the potable water supply and distribution system.

The Industrial Hygiene Program is administered for each Directorate by one of four ES&H Teams. Each ES&H Team is comprised of health and safety professionals including Industrial Hygienists. The Technical Leader for Industrial Hygiene from the Technical Support and Policy Development Division of Hazards Control monitors the field program to ensure that implementation of the program is consistently applied on a Laboratory-wide basis. The Industrial Hygienists are carefully selected professionals, who generally possess advanced academic degrees and are Certified Industrial Hygienists by the American Board of Industrial Hygiene. Elements of the Industrial Hygiene program are defined in the Health and Safety

Manual and the Hazards Control Manual. The Hazards Control Manual defines the roles of health and safety professionals and technicians. It also defines the requirements for Team and Discipline Action Plans. The Team and Discipline Action Plans are reviewed annually by the Industrial Hygienist, ES&H Team Leader, and Technical Leader for Industrial Hygiene and are updated as needed to address regulatory requirements and risk reduction, based on potential risk and current field experience.

Components of the Industrial Hygiene Program related to chemical safety include:

- *Health and Safety Manual* Chapters and associated Supplements:

  Chapter 2 - Integrating ES&H into Laboratory Activities
  Chapter 4 - Incident Analysis and Reporting
  Chapter 5 - Medical Program
  Chapter 6 - Design and Construction section on "Eyewashes and Safety Showers"
  Chapter 7 - Education and Training
  Chapter 8 - Hazardous Material Control
  Chapter 10 - Personal Protective Equipment
  Chapter 11 - Access Control, Safety Signs, and Alarm Systems
  Chapter 12 - Ventilation
  Chapter 21 - Chemicals
  Supplement 21.01 - Chemical Hygiene Plan for Laboratories
  Supplement 21.10 - Safe Handling of Beryllium and Its Compounds
  Supplement 21.11 - Safe Handling of Mercury
  Supplement 21.12 - The Safe Handling of Fluorine
  Supplement 21.13 - Hydrogen
  Supplement 21.14 - Safe Handling of Alkali Metals
  Supplement 21.15 - Safe Handling of Acids and Bases
  Supplement 21.16A - Safe Handling of Chemical Carcinogens in Research Laboratories
  Supplement 21.16B - Safe Handling of Chemical Carcinogens in General Work Areas
  Supplement 21.19 - Asbestos
  Supplement 21.20 - Lead
  Chapter 25 - Storage of flammables
  Chapter 26 - Hazards General and Miscellaneous
  Supplement 26.14 - Working in Confined Spaces
  Supplement 26.21 - Roof Access Procedure

- Hazards Review or Project Work Plan forms are used to evaluate chemical carcinogen projects per *H&S Manual* Supplement 21.16A "Safe Handling of Chemical Carcinogens in Research Laboratories" and Supplement 21.16B "Safe Handling of Chemical Carcinogens in General Work Areas".
- Hazards Assessment forms are used to evaluate projects and prescribe appropriate respiratory protection and/or exposure monitoring per *H&S Manual* Chapter 10, Section 10.05 "LLNL Respiratory Protection Program".
- Operational Safety Procedures (OSPs) and Facility Safety Procedures (FSPs).
- Equipment Release Forms are used for the evaluation of equipment that will be stored or reused in another location. Guidance for using the forms is provided in *H&S Manual* Supplement 8.07 "Equipment Repair, Transfer, Storage, and Excess."
- Controlled Items program for Procurement - requires ES&H Team signatures for chemical and hazardous materials purchases. A controlled items listing and authorized signatures for release of purchase orders for those items is transmitted from Hazards Control to the Procurement Department as items or signatures change. Authorized Procard purchasers must obtain prior approval from Hazards Control before placing credit card purchases for hazardous chemicals.

- Accident/Injury Reports are completed per *H&S Manual* Chapter 4 "Incident Analysis and Reporting" and the accident/injury report database is used regularly to determine trend analysis, including factors affecting the chemical safety program.
- Medical referrals, pregnancy consultations & exposure assessments, & work restrictions are done per *H&S Manual* Chapter 5 "Medical Program".
- MSDS Hotline.
- Design Reviews.
- Computer Databases for Hazard Assessments (hazards, personal protective equipment and monitoring/sampling activities), and MSDS's.

IH surveys are completed through work area tours, IH sampling, self-assessments, and review of safety documentation such as OSPs and FSPs. The surveys are documented on Hazards Assessment forms as described below. Routine monitoring is done under Discipline and Team Action Plans. Monitoring samples are analyzed by an on-site Industrial Hygiene Analytical Laboratory which is accredited by the American Industrial Hygiene Association.

Exposure Assessment and Monitoring Plan

Exposure assessments are performed to anticipate, recognize, evaluate, and control potential workplace hazards so that all employees are assured a safe and healthful work environment. The LLNL workplace involves a large variety of hazards, cc stantly changing operations and a mobile group of workers. Evaluation of these complex situations requires a sound, logical workplace exposure assessment and monitoring strategy to focus industrial hygiene, occupational medicine, and other occupational health resources on those work situations with the greatest risk or potential for adverse health effects. The LLNL Exposure Assessment and Monitoring Plan has recently been developed (April 1, 1995) to provide a consistent, systematic framework to accomplish at least the following five goals:

1. Assess potential health risks faced by all workers, differentiate between acceptable and unacceptable exposures, and control unacceptable exposures;
2. Establish and document records of all potentially exposed workers and communicate exposure monitoring results to each worker;
3. Referral of specific groups of exposed employees to Health Services for medical evaluation and surveillance;
4. Compliance with regulations and exposure guidelines; and
5. Efficient and effective allocation of time and resources to accomplish the above four goals.

This plan outlines a strategy for how industrial hygiene exposure assessment and monitoring will be implemented at LLNL. This plan goes beyond compliance and provides a comprehensive and integrated approach to the characterization of chemical, biological and physical (noise, non-ionizing radiation, and temperature extremes) stressors. A risk based approach is being used to focus industrial hygiene and occupational medical resources to those areas of greatest risk.

The development and implementation of the Exposure Assessment and Monitoring Plan is part of a performance measure under the University of California (UC) Contract as Criterion 1.1, Performance Measure 1.1.c. This performance measure is assessed annually to ensure continual progress towards the goal of preventing personnel exposures to toxic materials.

Exposure assessment and monitoring records have been computerized during the summer of 1995 and are to be made available to authorized Health Services and Hazards

Control Department personnel. Since this system will contain sensitive data, access will be protected from unauthorized users. Reports of exposure monitoring activities will be sent to potentially exposed employees, supervisors and ES&H assurance managers.

Chemical Safety Requirements

Requirements for chemical safety are provided in Chapter 8 and 21 of the LLNL *Health and Safety Manual* and their Supplements, and Chapter 10 of the LLNL *Environmental Compliance Manual*. This information is intended to provide the user of chemicals with requirements and guidelines for the safe use and disposal of such chemicals. Detailed information can be found in the specific chapters referenced and in the supplements.

Supplements to these *H&S Manual* chapters include detailed safety controls for beryllium and its compounds, mercury, fluorine, hydrogen, alkali metals, acids and bases, carcinogenic substances, work enclosures, lead, asbestos and asbestos products. There are also a specific supplement for the implementation requirement for the OSHA Lab Standard (Chemical Hygiene Plan). These documents are current and widely distributed throughout the Laboratory.

Controls for other hazards associated with chemicals are addressed in the *Health & Safety Manual* and associated Supplements including:

- Chapter 8 - Hazardous Materials Control
- Chapter 22 - Cryogens
- Chapter 24 - Explosives
- Chapter 33 - Radiation

Health Hazard Communication Program

LLNL's Health Hazard Communications Program, provided as Supplement 7.02 of the *H&S Manual*, is designed to ensure that all employees in LLNL work areas are informed about physical and health hazards from hazardous materials in the workplace. This program exceeds currently applicable OSHA requirements for hazard communication and includes the integral use of material safety data sheets (MSDSs), manufacturers' labels, formal training, and on-the-job training. Job-specific hazard information is provided by each supervisor at the work location. Additional specific health hazard training is provided to employees potentially exposed to chemicals with unique hazards and control measures, such as asbestos and lead.

Chemical Hygiene Plan

LLNL's Chemical Hygiene Plan, provided as Supplement 21.01 of the *H&S Manual*, specifically addresses all employees in LLNL Laboratory operations where short-term exposures to varying amounts of hazardous chemicals may be encountered. The Chemical Hygiene Plan was developed in accordance with OSHA requirements contained in Title 29, Code of Federal Regulations (CFR) Section 1910.1450 (Occupational Exposure to Hazardous Chemicals in the Laboratory). This chemical hygiene plan emphasizes worker training and safe work practices.

Carcinogens

Chemical carcinogen handling practices are addressed in Supplement 21.16A (Research Laboratories) and 21.16B (General Work Areas). LLNL's requirements for carcinogen use are based on OSHA regulations and DOE orders (5480.8A and 5480.10). Safety controls are established based on the potency of materials and the conditions found in a particular operation. Each material and its usage is evaluated individually and a hazard evaluation for each situation is completed to determine the appropriate handling procedures. LLNL's approach is intended to minimize exposure to levels as low as reasonably achievable. In some cases, these controls are also applied to other materials (e.g. teratogens, mutagens) with high toxicity.

4. Industrial Safety Program

Industrial Safety responsibilities in the area of chemical safety involve the safe design, use, and maintenance of pressure cryogenic systems, and explosives, and evaluating typical industrial hazards that may impact chemical safety (e.g., material handling).

The Industrial Safety Program is administered for each Directorate by one of the four ES&H Teams. The Technical Leader for Industrial Safety from the Technical Support and Policy Development Division of Hazards Control monitors the field program to ensure that implementation of the program is consistently applied on a Laboratory-wide basis. Industrial Safety Engineers are carefully selected professionals, who generally possess advanced academic degrees and are Certified Safety Professionals (CSP). Elements of the Industrial Safety program are defined in the *Health and Safety Manual* and the *Hazards Control Manual*. The *Hazards Control Manual* defines the roles of health and safety professionals and technicians. It also defines the requirements for Team and Discipline Action Plans. The Team and Discipline Action Plans are reviewed annually by the Industrial Safety Engineer, ES&H Team Leader, and Technical Leader for Industrial Safety and are updated as needed to address regulatory requirements and risk reduction, based on potential risk and current field experience.

The following program elements address these concerns:

- Health and Safety Manual Chapters and Supplements:

  Chapter 7 - Education and Training (Driver is primarily OSHA)
  Chapter 10 - Personal rotective Equipment (Driver OSHA)
  Chapter 22 - Cryogens (Driver is OSHA and DOT standards)
  Chapter 24 - Explosives and Supplements to Chapter 24
  Chapter 23 - Electricity
  Chapter 26 - General and Misc. Hazards, especially sections on Housekeeping, Confined Spaces, Roof Access and Lockout/Tagout
  Chapter 27 - Earthquake Safety and Supplement 27.02 Seismic Safety Program
  Chapter 29 - Material Handling, (Driver is OSHA)
  Chapter 32 - Pressure and Supplements to Chapter 32 (Driver is OSHA, DOT standards and DOE Orders)

- Hazards Review forms.
- Operational Safety Procedures and Facility Safety Procedures.
- Controlled Items program for Procurement - requires ES&H Team signatures.
- Accident/Injury Reports.

5. Fire Protection Program

The fire protection program is designed to meet requirements in DOE Order 5480.7, Federal Regulations 29 CFR 1910, and National Fire Protection Association (NFPA) standards. The program is implemented in all LLNL facilities in accordance with the guidance in Chapter 25 of the *H&S Manual*. The principal activities consist of:

- Controlling the use, storage and handling of combustible materials.
- Controlling fire hazards, for example, from welding, soldering, etc.
- Inspecting facilities and enforcing applicable fire and building codes.
- Inspecting and testing fire alarm and suppression systems.
- Maintaining a well trained and equipped emergency response force (i.e., Fire Department and Hazardous Materials Response Team).

6. Training Program

The Laboratory's training program is defined in the *LLNL Training Program Manual*. This manual provides LLNL training policies for job-related training, including ES&H training, assigns responsibilities, establishes requirements and provides implementation guidance. Training requirements are based on operational needs, and are intended to meet requirements in federal and state regulations, and in DOE directives. Also, training requirements are stipulated as part of the ES&H performance measures under Contract 48, Appendix F (Section A, Part 1). The goal of LLNL's ES&H training is to ensure that all personnel have the training required to protect health, and to perform their work in a competent, safe and environmentally sound manner. To that end, the following training program objectives were established to:

- Identify and document all training requirements (including those pertaining to ES&H issues) that are mandated by Laboratory management or outside authority, or otherwise determined to be necessary for performing a particular task or assignment.
- Provide mechanisms to assure that required training is accomplished.
- Document and make available all appropriate training-related information for use by authorized LLNL employees as well as for authorized external review purposes.
- Assure that the program is structured to permit adequate review and analysis of its effectiveness.
- Maintain a manual (the *LLNL Training Program Manual)* that provides guidance for implementing the program.

The management of the Laboratory's training program is a distributed task with specific responsibilities assigned to the Associate Directors (ADs), their line managers and employees, Laboratory teaching organizations, the Laboratory Training Manager, and the Training Program Committee. The Training Program Committee performs the following functions:

- Maintains an awareness and overview of the Training Program and resolves issues as appropriate.
- Reviews and concurs with all changes to the *LLNL Training Program Manual*, including the addition or removal of institutional training requirements and any substantive changes to the record-retention process or policy.

In general, the ADs, in their combined roles of Program, Facility and Payroll senior managers are required to maintain a training program plan that describes key objectives, establishes clear

lines of responsibilities and communications for the training program, and identifies institutional and special training requirements. In addition, the directorates and their line organizations and facilities maintain records of training requirements and the related satisfactory course-completion records for their employees. Employees are required to attend, and are expected to satisfactorily complete, all assigned training courses.

Chemical safety related training courses currently available to LLNL employees include;

- New Employee Safety Orientation
- Environment, Safety, and Health for Mangers
- Health and Safety for Employees and Visitors at Site 300
- Operating with the Fire Department at Emergencies
- Medic First Aid and Cardiopulmonary Resuscitation
- Qualification for Fire Extinguisher Users
- Explosives Safety
- Health Hazards Communication for Supervisors
- Health Hazards Communication for Supervisors of Chemical Labs
- Confined Space Entry
- Confined Space Instruments
- Hydrofluoric Acid
- Chemical Safety
- Laboratory Safety
- Beryllium
- Alkali Metals
- Asbestos Safety
- Respiratory Protection
- Pressure Safety

The official records of successful course completions by employees are maintained in the Laboratory Repository of Completed Courses (LROCC) database. This database is maintained by the Information Resources Division (Human Resources Department) who receive the course-completion information from the teaching organizations.

Teaching organizations develop, or obtain and present courses to meet training requirements. Most ES&H-related courses are provided by the ES&H support organizations; i.e., the Hazards Control and Environmental Protection Departments, and by the Emergency Preparedness and Response Program. However, all directorates may provide courses to meet unique training requirements. Guidance for the development, review, updating and documentation of the process, and for qualifying instructors, is provided in the *LLNL Training Program Manual.*

Changes to the *LLNL Training Program Manual*, including changes to the list of institutional courses, are developed by the Laboratory Training Manager based on input from Laboratory organizations. After review by the Laboratory Counsel's Office, and concurrence by the Training Program Committee, changes to the manual are forwarded to the Deputy Director for Operations for approval.

7. Hazardous Waste Management and Environmental Compliance Programs

An Environmental Protection Department (EPD) *Environmental Compliance Manual* has been developed to assist LLNL personnel in complying with environmental requirements. This Manual summarizes the environmental regulatory programs and requirements affecting LLNL operations. Each section outlines how LLNL activities and operations are regulated and whom to

contact for further information. This Manual is not intended to provide comprehensive guidance on each regulatory area; instead, it provides LLNL personnel with an overview of environmental requirements and enough information to determine whether:

- Environmental permits are required (e.g., an air quality permit);
- Environmental analyses must be performed (e.g., an environmental impact statement or report);
- Environmental plans must be prepared and implemented (e.g., an emergency response plan);
- A chemical release must be reported (e.g., a hazardous waste spill); and
- Records (and what kinds) must be kept.

Because some environmental activities or media (i.e., air, water, land) are regulated by more than one environmental program, the Manual is structured by functional topics, not environmental regulatory programs.

All hazardous, medical, radioactive and mixed wastes generated by Laboratory operations must be managed in compliance with applicable federal and state laws, regulations, RCRA permits, and requirements in DOE directives, e.g., DOE Orders 5400.1, 5400.3, and 5820.2A. In addition, acceptance requirements for transuranic and low-level radioactive wastes at DOE sites have to be met.

The Hazardous Waste Management Division (HWM) in EPD supports Laboratory waste generators by performing the following functions:

- Processing, storing, packaging, solidifying, treating, or preparing waste for shipment to treatment and disposal facilities, for recycling, or for discharge to the sanitary sewer.
- Tracking and documenting the movement of hazardous, radioactive and mixed wastes from Waste Accumulation Areas (WAAs) to disposal.
- Decontaminating Laboratory equipment.
- Ensuring that containers for shipment of waste meet specifications of the Department of Transportation and other regulatory agencies.
- Responding to emergencies and participating in the cleanup of hazardous and radioactive material spills at LLNL facilities.
- Designing, operating and maintaining waste handling facilities and equipment.
- Operating the Chemical Exchange Warehouse to facilitate reuse of chemicals.

All waste generators are responsible for performing the following activities:

- Completing training in hazardous waste handling practices.
- Requesting sampling and analysis to identify unknown waste constituents.
- Segregating wastes and package it in approved containers.
- Using and filling in appropriate labels for labeling the waste containers.
- Complying with rules governing the accumulation of waste at or near the point of origin.
- Preparing waste containers for movement from the work area to a WAA and filling out an appropriate waste disposal form.

- Storing sealed waste container in the WAA.

HWM provides full service management of hazardous, radioactive, and other regulated wastes generated in LLNL facilities. Waste technicians are highly trained and skilled to handle hazardous waste efficiently. This has significantly reduced historic concerns about chemical compatibility, improper identification, exceeding accumulation time limits, waste segregation, mixing of waste streams, waste minimization, and tracking of waste containers. Researchers who infrequently generate waste have been able to devote more time to conducting research instead of trying to remember how to manage the waste correctly. Generators and handlers of hazardous, radioactive, and regulated wastes are required to successfully complete the course *Hazardous Waste Handling Practices*, EP0006, annually. This course provides detailed information on management of the wastes at the point of generation, and an overview of WAA management to meet regulatory requirements and policy. The guidance document, *Guidelines for Waste Accumulation Areas*, March 1989, UCAR-10192, Revision 1 provides detail on responsibilities of various organizations.

The procedures document entitled, *Criteria and Procedures for the Certification of Nonradioactive Hazardous Waste, Volumes 1-3*, August, 1992, UCRL-AR-109662, describes how LLNL certifies waste that is not radioactive when generated in areas where the potential for radioactivity exists.

Waste Minimization and Pollution Prevention Awareness

Under the Director's Waste Minimization Policy, the Laboratory is committed to minimizing waste from Laboratory operations, particularly hazardous, mixed and radioactive waste. Activities to implement this policy include:

- Developing specific goals and schedules for waste minimization activities and documenting the goals and schedules.
- Characterizing waste streams and developing a baseline of waste generation data.
- Identifying opportunities for waste minimization in on-going and new operation and projects.
- Reducing or eliminating waste through source reduction (e.g., product changes, technology changes and good operating practices) and recycling and reclamation.
- Enhancing communication of waste minimization goals, objectives, methods, techniques and successes among Laboratory organizations.
- Evaluating the effectiveness of the program and preparing an annual report, and other waste minimization and pollution prevention documents.

Pollution Prevention Awareness activities complement the waste minimization effort. These activities are implemented by the EPD, and involve primarily education and communication activities.

Chemical Exchange Warehouse Project

HWM implemented the Chemical Exchange Warehouse (CHEW) project in October 1993. The CHEW project is designed to identify and temporarily store excess, usable chemicals until requested by someone who will use them productively. Instead of buying new chemicals from a commercial supplier or manufacture, a user can obtain

excess chemicals free-of-charge from CHEW. When programs shut down, employees retire, or inventories are reduced, many usable chemicals are sent to HWM for disposal. Unused chemicals represent a substantial portion of HWM's waste and managing these still usable materials as hazardous waste is expensive. CHEW promotes waste minimization and results in considerable savings by reducing the amount of new chemicals that need to be purchased as well as reducing costs of hazardous material disposal.

Any LLNL employee can access the CHEW chemical inventory from the Laboratory computer network. Chemicals or chemicals products may be selected from the list for delivery by a CHEW technician. Items are kept on the CHEW inventory for a maximum of one year.

8. General Chemical Safety Programs

Hazardous Materials Packaging and Transportation Safety Program

The Hazardous Materials Packaging and Transportation (HMPT) Program establishes responsibilities, requirements, and controls for the packaging and on-site transportation of Category 1, 2 and 3 hazardous materials, substances, and wastes. The objectives of the HMPT Program are to ensure that operations involving the packaging and on-site transfer of hazardous materials, substances and wastes shall be conducted to:

- Protect the health and safety of employees, subcontractor employees, visitors and the public;
- Protect the environment;
- Protect the hazardous material during transport; and to
- Comply with applicable federal, state, and local regulations and requirements.

The program is intended to meet the requirements of the DOT Hazardous Materials Regulations (49 CFR 100–180), the EPA RCRA Regulations (40 CFR 115, 116 and 262), the California Code of Regulations (22 CCR, Chapter 30), and DOE Order 5820.2A. Laboratory requirements are specified in the *On-site Hazardous Materials Packaging and Transportation Safety Manual* and in Chapter 8 of the *H&S Manual.*

The HMPT Program is managed by the HMPT Safety Committee. The Committee performs the following functions:

- Oversees the program and ensures its implementation and coordination throughout the Laboratory.
- Approves all new and/or revised packaging and transportation procedures.
- Initiates appraisals of hazardous materials and packaging operations and tracks corrective actions resulting from such appraisals.
- Issues the HMPT Quality Assurance (QA) Plan and implementing procedures, and ensures compliance with the QA Plan.

Each cognizant Laboratory organization performs the following activities:

- Receive, package and transfer hazardous materials in accordance with approved procedures.
- Provide guidance to Laboratory personnel on the correct methods for packaging (i.e., containment), labeling and on-site transfer operations.

- Provide approved containers for packaging of hazardous materials to Laboratory employees.
- Train personnel and maintain training records.
- Perform the QA activities and maintain QA records as called out in the organization's QA Plan.
- Establish and implement controls for loading and unloading of vehicles.
- Establish and implement controls for the use of tie-downs to secure loads, and for the operation, placarding, maintenance and inspection of vehicles used to transport hazardous materials.
- Prepare emergency procedures for spills and fires involving hazardous materials and transport vehicles.

ES&H Management Plan

Some LLNL Directorates, including the Chemical & Materials Science Directorate and the Physics & Space Technology Directorate, have prepared ES&H Management Plans to describe the management of Environmental, Safety, and Health (ES&H) activities in their areas. Each plan describes the organization of the Directorate, ES&H responsibilities for management and workers, facilities, and how ES&H requirements are met. Each Assurance Office is responsible for maintaining this docu ·ent and coordinating its annual review.

The LLNL philosophy is that everyone shares the responsibility for creating and maintaining a safe and compliant workspace. All personnel are responsible for understanding their ES&H roles and responsibilities. Each ES&H Management Plan provides guidance to personnel working on programs or working in facilities on how to identify and fulfill these responsibilities.

LLNL Emergency Response Plan

LLNL has developed an Emergency Plan (EP) which describes the Lawrence Livermc National Laboratory's (LLNL's) Emergency Management System (EMS)—a syste designed to respond to mitigate potential consequences of credible on-site and significa nearby emergencies that could threaten Laboratory workers, the public, national security, the environment. The planning, preparedness and readiness assurance activities describ in this EP demonstrate LLNL's commitment to a vigorous program of emergen preparedness and response capabilities throughout the entire site.

In addition, Department of Energy (DOE) Order 5500.3A, "Planning and Preparedness l Operational Emergencies," dated 4/30/91, requires LLNL to prepare and maintai comprehensive EP. DOE's emergency management sub-guide, "Standard Format a Content For Emergency Plans," dated 12/11/92, establishes the EP format and conte This EP satisfies these requirements and integrates requirements from other DOE ord associated management guides, and DOE Oakland Operations Office (DOE/OA supplements.

This EP describes the EMS's organizational elements, interfaces, authorit responsibilities, resources, and predetermined actions to be taken in response to an actua potential emergency. It describes the activities necessary to assure the readiness of the site Emergency Response Organization (OERO), and it puts forth the provisions for rapid mobilization and expansion of the response commensurate with the magnitude of emergency and provides for reentry and recovery operations. This EP further serves

guidance document to ensure the health and safety of personnel during and immediately following an emergency. Working procedures to be followed during an actual emergency are contained in the Emergency Plan Implementation Procedures.

On-Site Preparedness Program

The Laboratory's On-Site Preparedness Program (OSPP) establishes responsibilities and requirements, and assigns functions and activities for emergency planning, preparedness, response and readiness assurance. Additional elements of the OSPP are:

- Site Evaluation Program.
- Self Help Program.
- Occurrence Reporting Program.

The primary objectives of the OSPP are to ensure that:

- Facility-specific and site-wide emergency response plans and procedures are prepared.
- Personnel are trained and equipped to manage and respond to credible emergencies.
- Emergencies are managed in an effective and timely manner to mitigate consequences.
- Capabilities are maintained to support and assist DOE in the event of radiological or nuclear emergencies.

The OSPP is intended to meet the requirements in DOE Orders 5500.1B, 5500.2B, 5500.3A and 5500.10, and the *DOE Emergency Management Guide.* Laboratory guidance is provided in Chapter 3 of the *H&S Manual* and the *LLNL Draft Emergency Plan.*

The Laboratory has designated an Emergency Response Program Administrator to administer and coordinate all elements of the OSPP. The administrator manages the OSPP Office which provides the following functions:

- Coordinating, scheduling and publishing the duty assignments for the Laboratory Emergency Duty Officers (LEDOs) and supporting duty officers, e.g., from the Fire Department, Public Information Office, etc.
- Coordinating the Laboratory's efforts in support of various DOE emergency preparedness and response programs (e.g., ARG, FRMAC, NEST and RAP).
- Developing and publishing the *LLNL Draft Emergency Plan* and *Implementing Procedures.*
- Maintaining the Laboratory's Emergency Management Center (EMC) ready for instant activation and operation.
- Developing, providing and documenting performance-based training for LEDOs, Emergency Management Team (EMT) and EMC support personnel.
- Conducting and documenting drills and table-top exercises for EMT and EMC personnel.
- Planning, controlling, conducting and evaluating exercises involving all on-site and off-site emergency response organizations in order to test the Laboratory's emergency preparedness and response.

Site Evaluation Program

To provide a basis for the *LLNL Draft Emergency Plan*, the training of EMT personnel and for the conduct of drills and exercises, a Site Evaluation Program has been implemented.

Line organizations are responsible for the following actions:

- Identify facility hazards and prepare and document hazards analyses (HAs).
- Perform facility-specific safety analyses using credible accident scenarios and document the analyses in safety analysis reports (SARs).
- Submit the HAs and SARs to the Emergency Preparedness Response Program (EPRP) Administrator.

The EPRP Office uses the hazards and safety analyses to:

- Develop emergency planning zones and the *Emergency Response Guide (ERG).*
- Maintain and revise the ERG to reflect changes in facility operations, hazards, and accident scenarios.

Self-Help Program

The Self-Help Program has been established as a fundamental component of the Laboratory's EPRP. The Self-Help Program will be activated in the event of a site-wide disaster, e.g., a major earthquake. Laboratory guidance is set forth in Chapter 3 of the *H&S Manual* and in Chapter 2 of the *LLNL Draft Emergency Plan.*

Key activities performed by the line organizations include:

- Designating Self-Help Zone supervisors and Assembly Point leaders and defining their responsibilities and authorities.
- Developing and publishing organizational Self-Help Plans in accordance with Laboratory guidance.
- Establishing building evacuation routes and personnel assembly points, and providing self help kits at these locations.
- Participating in periodic, site-wide exercises of the Self-Help Program.

The EPRP Office supports the Self-Help Program by:

- Providing guidance to Laboratory organizations.
- Coordinating the establishment of Self-Help Zone boundaries.
- Publishing Self-Help Zone Maps.
- Developing and providing training for Self-Help Zone supervisors and Assembly Point leaders.
- Conducting periodic reviews of organizational Self-Help Plans, assembly point locations and self-help kits.

Occurrence Reporting Program

The Laboratory's Occurrence Reporting Program is intended to meet the requirements of DOE Order 5000.3B. LLNL policy and guidance on occurrence reporting are set forth in

Chapter 4 of the *H&S Manual*, and in the associated *LLNL Implementing Procedure - DOE Order 5000.3B*. The program is implemented by all line organizations and requires the prompt notification and/or reporting of DOE-reportable occurrences via line management to the Occurrence Reporting Office.

The Occurrence Reporting Office (ORO) is part of the EPRP and provides for the Laboratory a centralized reporting function to DOE. In addition, the ORO performs the following support functions:

- Maintains the LLNL Occurrence Reporting and Processing System (ORPS) computer terminal, and central files for LLNL occurrence reports.
- Maintains a cadre of trained "Occurrence Reporting Duty Officers" to provide telephonic notification to the DOE Emergency Operations Center regarding emergencies and unusual occurrences.
- Develops and conducts training for employees in the preparation of occurrence reports.
- Issues monthly and quarterly reports on the status of LLNL occurrence reports.

Conduct of Operations Program

The Laboratory's Conduct of Operations Program is intended to meet the requirements of DOE Order 5480.19A. LLNL guidance on the development and implementation of this program is set forth in *H&S Manual*, Supplement 2.19, Conduct of Operations. The Conduct of Operations (ConOps) requirements are being implemented in all LLNL hazard-ranked nuclear and non-nuclear facilities. ConOps is part of a performance measure under the University of California (UC) Contract as Criterion 3.4, Performance Measure 3.4.a. This performance measure is assessed annually to ensure continual progress towards the goal of integrating the principles of ConOps into Laboratory operations.

Designated "Facility Managers" or managers to whom the Facility Associate Director has delegated responsibility for facility operations perform the following activities:

- Evaluate the applicability and compliance status of each of the 18 elements and associated sub-elements of the ConOps order using the *H&S Manual* Supplement 2.19, and document the results in a ConOps workbook.
- For any non-compliant but applicable elements and sub-elements, prepare an implementation plan to bring the operations into compliance. Justify, using a cost-benefit approach, if any ConOps elements (sub-elements) are not to be implemented.
- Develop implementing procedures for the non-compliant elements and sub-elements and conduct operations as per procedures.
- Maintain records of all approved ConOps procedures and related documentation and revisions.
- Provide ConOps training for supervisors, operating and maintenance personnel in accordance with LLNL institutional training requirements.
- Conduct periodic self assessments of ConOps implementation and improve operations based on the self-assessment findings.

Lessons Learned Program

The Hazards Control Department has implemented a Laboratory-wide ES&H Lessons

Learned program to reduce the occurrence of accidents and injuries by sharing experiences of other individuals and organizations. This program gathers information from a wide range of sources throughout the United States and focuses on those issues most relevant to the Lab. Selection of the experiences for sharing is done by an advisory group that includes representatives from the Assurance Review Office, Engineering, and the Environmental Protection, Hazards Control, Health Services, and Technical Information Departments. Distribution is by electronic mail to a list of 500 managers and supervisors selected by Assurance Managers.

All Lessons Learned communications follow the basic format of "what happened, lessons learned from the incident, where to get additional information or help, and recommendations on actions to be taken." Topics covered through September 1994 include:

- Improperly Labeled Chemicals Found to be Explosive
- Voltage Checks Identify Electric Shock Hazards
- Suspect/Counterfeit Parts Continue to be Found at LLNL
- Improperly Mounted Face Plates Pose Electrical Hazards
- Serious Electrical Shock at LANL
- Smoke and Other Indicators of Possible Fire Should be Reported Immediately
- Do-it-yourself Modifications Can Be Dangerous

Managers who receive these documents are encouraged to distribute them to their employees and post them on bulletin boards.

GENERIC VULNERABILITIES

Generic Vulnerability: **Abandoned chemicals and chemical residuals**

Determination

1) **Identify processes or operations potentially impacted by the vulnerability.**

Site-wide impact

2) **Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.**

Each building at LLNL is assigned to a specific Associate Director designating overall responsibility for the building. These assignments are listed in the LLNL facility condition and use assessment/tracking system. Each building is assessed as described in further detail under the Generic Vulnerability, *Condition of facilities and support systems*. This system of designated responsibility works to ensure that all buildings are accounted for and no buildings are abandoned.

The Chemical Safety Management Systems Summary describes the numerous checks and balances at the LLNL site which act to minimize the potential for abandoned chemicals and chemical residuals. In addition, LLNL has the following guidance and required programs to address aging and/or changing Laboratory activities in order to minimize the risk posed by this potential vulnerability.

Supplement 2.10 of the LLNL *H&S Manual, Shutdown, Surveillance, and Maintenance Requirements for Inactive Facilities, Equipment, and Experiments*, provides guidance to programs that are planning to shut down a facility or deactivate part of a facility and its associated operations. Facilities that have been contaminated with hazardous materials are managed in a safe manner at all times to ensure the protection of employees and the public. A shutdown, surveillance and maintenance plan must be developed for all deactivated facilities and operations.

Draft guidelines entitled *Guidelines for the Safe Temporary Shutdown and Surveillance of Facilities* have been recently developed and successfully applied to a LLNL facility. This information is intended for facilities which are planned for temporary shutdown only (up to but not exceeding 1 year). Pre-shutdown, surveillance and maintenance recommendations are provided relating to industrial hygiene, health physics, industrial safety, environmental protection, and fire protection. These guidelines will be incorporated into Supplement 2.10 of the *H&S Manual* (described above).

Supplement 8.07 of the *H&S Manual, ES&H Requirements for Equipment Repair, Transfer, Storage, and Excess*, was released in August 1994 and has been implemented to ensure safe handling of equipment during its life cycle. Procedures are detailed to certify that LLNL and DOE equipment is free of radioactive or hazardous materials before such equipment is transferred on-site or off-site for repair, maintenance, or storage; on-site for reuse; or into the excessing system.

3) **Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities**

should be addressed in Step 3.

Current LLNL programs reduce the potential vulnerability to acceptable levels. No further actions are necessary for mitigation.

Generic Vulnerability: **Past chemical spills and ground releases**

Determination

1) Identify processes or operations potentially impacted by the vulnerability.

Site-wide impact

2) Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.

The Chemical Safety Management Systems Summary describes the numerous checks and balances at the LLNL site which act to minimize the potential for contact with past chemical spills and ground releases. All LLNL environmental cleanup, remediation and restoration work is performed in accordance with OSHA, EPA and DOE requirements described by a comprehensive site Health & Safety Plan complemented with Standard Operating Procedures.

A Federal Facilities Agreement (FFA) was adopted in November 1988 for the main LLNL site and a FFA was signed in June 1992 for Site 300. The FFAs specify approved cleanup activities including scope and schedule. At the main LLNL site, cleanup actions include;

- Pumping water from 18 initial locations to contain and remediate the plume of contaminants in the groudwater,
- Constructing ten on-site treatment facilities to treat the extracted groudwater using ultraviolet (UC)/oxidation, air stripping, ion exchange and granular activated carbon, and
- Removing contaminant vapors in the soil by vacuum-induced venting and treatment by catalytic oxidation and activated carbon.

Additional remedial action details are also reported in a January 6, 1993 document entitled, *Remedial Action Implementation Plan*, and Remedial Design Reports for the various treatment units.

At Site 300, a Remedial Investigation Report and two feasibility studies have been completed. An additional feasibility study is in progress and a Record of Decision is expected in 1998.

LLNL site cleanup activities and associated requirements are described in more detail in the LLNL *Environmental Compliance Manual.* In addition, an *Environmental Report* is issued annually which summarizes LLNL environmental monitoring and compliance efforts for the previous year. This report contains detailed information including future plans.

3) Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities should be addressed in Step 3.

The LLNL site is a well characterized site in terms of chemical contaminants in the local environment, including the soil and ground water. Most of the chemical contaminant levels at the LLNL site are at such low concentrations that occupational exposure potentials with adverse health affects are unlikely.

Current LLNL programs and controlled clean-up efforts reduce the potential vulnerability to acceptable levels. No further actions are necessary for mitigation.

Generic Vulnerability: **Characterization of legacy chemicals and wastes**

Determination

1) **Identify processes or operations potentially impacted by the vulnerability.**

Site-wide impact

2) **Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.**

The Chemical Safety Management Systems Summary describes the numerous checks and balances at the LLNL site which act to minimize the potential for contact with legacy chemicals and wastes. In particular, the ChemTrack system and Hazardous Waste Management program (including CHEW) work to minimize potential impact of this vulnerability at LLNL.

In addition, the management systems described above which mitigate the potential for *abandoned chemicals and chemical residuals* also serve to mitigate this vulnerability.

3) **Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities should be addressed in Step 3.**

Current LLNL programs reduce the potential vulnerability to acceptable levels. No further actions are necessary for mitigation.

Generic Vulnerability: **Disposition of legacy chemicals**

Determination

1) **Identify processes or operations potentially impacted by the vulnerability.**

Site-wide impact but primarily older facilities and facilities which house discontinued, or soon to be discontinued, operations.

2) **Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.**

The Chemical Safety Management Systems Summary describes the numerous checks and balances at the LLNL site which act to minimize the potential problems associated with the disposition of legacy chemicals. In particular, the ChemTrack system and Hazardous Waste Management program (including CHEW) work to ensure accountability of legacy chemicals and ultimate disposition of these materials.

In addition, the management systems described above which mitigate the potential for *abandoned chemicals and chemical residuals* also serve to mitigate this vulnerability - particularly the requirements and guidelines for the shutdown of facilities including; Supplement 2.10 of the LLNL *H&S Manual*, "Shutdown, Surveillance, and Maintenance Requirements for Inactive Facilities, Equipment, and Experiements"; Guidelines for the Safe Temporary Shutdown and Surveillance of Facilities ; and Supplement 8.07 of the *H&S Manual*, "ES&H Requirements for Equipment Repair, Transfer, Storage, and Excess".

3) **Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities should be addressed in Step 3.**

Current LLNL programs reduce the potential vulnerability associated with the disposition of legacy chemicals to acceptable levels.

Generic Vulnerability: Storage facilities and conditions

Determination

1) **Identify processes or operations potentially impacted by the vulnerability.**

Site-wide impact

2) **Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.**

The Chemical Safety Management Systems Summary describes the numerous checks and balances at the LLNL site which act to minimize the potential for chemical safety problems associated with storage facilities and conditions. In particular, the Hazard Assessment and Safety Analysis Program, routine industrial hygiene and self-assessment program walk-throughs and monitoring of chemical work areas, chemical and carcinogen safety requirements specified by the *H&S Manual*, fire protection storage requirements, health and safety training programs, HWM requirements and all of the general chemical safety programs, described in the Chemical Safety Management Systems Summary, work to minimize the potential impact of this vulnerability at LLNL.

3) **Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities should be addressed in Step 3.**

Current LLNL programs reduce the potential vulnerability to acceptable levels. No further actions are necessary for mitigation.

Generic Vulnerability: **Condition of facilities and support systems**

Determination

1) **Identify processes or operations potentially impacted by the vulnerability.**

Site-wide impact but primarily the oldest LLNL facilities

2) **Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.**

LLNL Plant Engineering Space and Site Planning group with guidance from the DOE Strategic Facilities Initiative Program developed and implemented a facility condition and use assessment/tracking system. All LLNL facilities are included in the system and are assessed using the following criteria to define the condition of the buildings;

Excellent - Performs to original specifications. Generally requires only preventive maintenance. Easily restorable to "like new" performance.

Good - Performs to important original specifications with extra operations attention, some reasonable extra maintenance. Downtime does not effect operations.

Adequate - Meets program requirements/departmental mission assignments, but cannot perform to all original specifications. Corrective as well as preventive maintenance required/cost not excessive. Downtime does not unduly affect operations.

Fair - Occasional substandard output even with careful operator attention. Repetitive corrective maintenance needed. Total maintenance costs exceed economic operations. Operations occasionally impeded by downtime. Expensive to be made adequate for current use but could easily be converted to another use.

Poor - Consistent substandard performance. Excessive maintenance costs. Operations continually threatened by breakdowns. Cannot be made adequate at any cost, should be removed or demolished.

This system is used to manage and plan for aging facilities in advance of facility shutdown. An example page from this tracking system is provided as Attachment I illustrating the type and quality of information in the system. Current implementation and acceptance of this system is good.

3) **Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities should be addressed in Step 3.**

Current LLNL programs reduce the potential vulnerability to acceptable levels. No further actions are necessary for mitigation.

Generic Vulnerability: **Unanalyzed and unaddressed hazards**

Determination

1) **Identify processes or operations potentially impacted by the vulnerability.**

Site-wide impact

2) **Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.**

The Chemical Safety Management Systems Summary describes the numerous checks and balances at the LLNL site which act to minimize the potential for unanalyzed and unaddressed hazards. In particular, the Hazard Assessment and Safety Analysis Program, routine industrial hygiene and self-assessment program walk-throughs and monitoring of chemical work areas, and all of the general chemical safety programs, described in the Chemical Safety Management Systems Summary, work to minimize potential impact of this vulnerability at LLNL.

3) **Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities should be addressed in Step 3.**

Current LLNL programs reduce the potential vulnerability to acceptable levels. No further actions are necessary for mitigation.

Generic Vulnerability: Inventory control and tracking

Determination

1) **Identify processes or operations potentially impacted by the vulnerability.**

Site-wide impact

2) **Describe management systems currently in place to mitigate the vulnerability. Reference applicable portions of the chemical management systems summary, prepared in Step 1.**

LLNL's chemical inventory and management system (ChemTrack) is fully described in the Chemical Safety Management Systems Summary.

3) **Discuss the adequacy of management systems to control the vulnerability. Only those vulnerabilities which require further mitigating activities should be addressed in Step 3.**

The ChemTrack system has been implemented sufficiently to adequately reduce the risk posed by the potential vulnerability to acceptable levels. Additional applications in the areas of industrial hygiene are planned which will further reduce LLNL's risk in this area. No further actions are necessary for mitigation.

Attachment I

Sample page from facility assessment and tracking system

ENVIRONMENT, HEALTH
& SAFETY DIVISION

December 22, 1997
DIR-98-39

TO: Richard Nolan
DOE Site Office

FROM: David McGraw, Director
Environment, Health & Safety Division

SUBJECT: Management of Chemical Hazards

Please find enclosed the final submission in response to Dr. James Turner's request for information as part of the report to Secretary Pena assessing chemical and radiological vulnerabilities. The initial submission was forwarded on December 10, 1997.

This document contains a description of the Berkeley Lab's program for assessing facility and operational vulnerabilities on an on-going basis, including training, technical competence and the Lessons Learned program. An additional document describes the Lab's management and resolution of previously identified chemical and radiological vulnerabilities at facilities and operations either shut down or undergoing change over to another mode of operation.

In the interest of providing you with a complete package, the previous submission is included as Enclosure (3).

Enclosures: (1). Berkeley Lab's Hazard Assessment and Controls Programs
(2). Chemical Vulnerabilities of Facilities in Transition
(3). Management of Chemical Hazards, December 10, 1997

DCM:ep

Attachment

ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY
UNIVERSITY OF CALIFORNIA | BERKELEY, CALIFORNIA 94720
TEL: 510.486.5514 | FAX: 510.486.7488

Berkeley Lab's Hazard Assessment and Controls Programs

INTRODUCTION: The following programs at Berkeley Lab are designed to identify hazards and establish controls. The programs have evolved from thirty years of experience and have not changed sustantitvely for the past seven years. Change control is established by identifying health, safety and environmental professionals to participate in all projects of the Facilities Department (see 2.g below).

Activity Authorization: Activities are authorized by either Line Management or by joint EH&S/Line Management. EH&S Division health and safety professionals provide guidelines in the LBNL Health & Safety Manual, Publication 3000 (PUB-3000), indicating the authorization level. Lower hazard activities are determined by EH&S safety professionals to be activities that Line Management review is adequate. Higher hazard activities are determined by EH&S safety professionals to require joint EH&S/Line Management review and authorization.

Line Management Authorization: Bench Level Activities that do not require EH&S participation in hazard identification and mitigation are authorized by line management. The hazard review and establishment of controls are the responsibility of the Principle Investigator (PI).

EH&S Level Authorization: Activities requiring EH&S participation in the hazard identification and mitigation process are identified in PUB-3000. Hazard identification, establishment of controls and authorization are the responsibility of the PI and appropriate EH&S safety professionals. Authorization examples include Activity Hazard Documents (AHD), Radiation Work Authorizations (RWA) and Radiation Work Permits (RWP).

Hazard Identification and Establishment of Controls:

1. **Line Management Level:** The PI effects hazard assessment for research projects. The Hazard Assessment Guide Table (PUB-3000, Chapter 6), with EH&S assistance if requested, is used as a tool to identify hazards, determine mitigation and determine authorization. Hazard identification and mitigation are included in the preparation process for Research Funding Proposals. Line management requests assistance from EH&S on an "as-needed" basis. All proposals are reviewed by the NEPA/CEQA group for compliance. The PI initiates change control when there is an addition of a new hazard or an increase in the hazard level.

2. **Joint EH&S/Line Management Level Authorization:**

   a. **Integrated Functional Appraisal /Integrated Hazard Appraisal Programs**: Programs are conducted by EH&S subject matter experts with

line management, and representatives of the division safety group (DSC) and are designed to identify and evaluate hazards in the workplace to enhance divisions self assessment program. Identified hazards and corrective actions are reviewed with line management as they are identified. Formal written reports are issued at the conclusion of the evaluation.

b. **Chemical Hygiene and Safety Program**. The program implements the provisions of Federal OSHA Haz Com and Laboratory Standards. It is designed to identify, recognize and control chemical hazards in both industrial and laboratory settings.

c. **AHD Program**: EH&S professionals review higher hazard activities with line management to identify hazards and establish controls before activation. Hazards requiring AHD's are identified in PUB-3000 (e.g. Health Hazard Gases NFPA Class 3 and 4 and Class 2 with poor warning properties).

d. **Radiation Protection Program:** All activities with radionuclides are reviewed by safety professionals with line management to identify hazards and establish controls. The activities include the Radiation Work Authorization (RWA), Radiation Work Permit (RWP), and Sealed Source Authorization (SSA) processes. All construction/demolition activities that involve materials with residual radioactive contamination or induced activity are reviewed by safety professional under these programs.

e. **Accelerator Experiment Review Programs**: These programs evaluate the hazards and establishes controls. The user submits an Experiment Form describing the experiment and all potentially hazardous materials and equipment to be used. This allows the accelerator facility staff to assist in identification of hazards and establishment of controls.

Prior to the beginning of the experiment the accelerator facility staff completes an Experiment Summary Sheet (ESS) that describes the experimenters, equipment, and hazardous materials that are approved for each experiment. The ESS must be completed and posted at the Beamline before the experiment can begin.

The ESS is a living document and is updated to include any changes to the experiment and their review. The entire experiment including equipment, experimenters, and chemicals is reviewed every six month at which time a new ESS is issued.

f. **SAD Program**: The Safety Analysis Document program evaluates facilities to assure that potential risks for onsite and offsite exposures from normal and accidental emissions are operated at a low hazard level. The

program identifies activities with potential onsite and offsite consequences and analyzes the activities to assure operating controls are in place.

g. **Facilities Department Projects:** A Project Coordination Committee has the responsibility of balancing Facilities Department priorities at the institutional level. The Project Coordination Committee is facilitated by the Facilities Department and consists of representatives from each of the Laboratory's resource divisions and the Office of Planning and Communications. The Committee performs two functions: (1) it informs all resource divisions of upcoming projects and allows for advance coordination when required, and (2) it provides a broad-based review of projects using a priority rating system. From the Committee review, a recommended list of prioritized projects is compiled. This in turn is submitted for collective review to the Facilities Manager and the Director of the Environment, Health and Safety Division, who in turn advise the Deputy Director for Operations regarding preparation of a final list. Projects that are not funded are periodically reviewed with the proposing division during the year, and may be resubmitted for funding during the next "Unified Call" process.

In addition to the balancing priorities process, Facilities Department design and construction projects are reviewed to identify health and safety issues. Appropriate EH&S subject matter experts participate in the design and construction stages to assure hazards are identified and appropriate controls are included in the project.

Small Projects: Projects with a funding level of $100k and less are managed by the Facilities Department Small Projects Group. A representative of the EH&S Hazard Assessment Program attends weekly project planning meetings to review the scope of current projects, identify ES&H subject matter experts and resolve ES&H issues.

Major projects (funded with GPP/MELFS funds): The Hazard Assessment Program identifies an EH&S Team Leader and supporting team to participate in all projects. Subject matter experts identify issues during design, assure proper controls are included in the design and follow the project through construction to assure the completed facility meets the design criteria.

h. **Division Self Assessment:** Each division has a self-assessment program to continually evaluate the effectiveness of its ES&H hazard identification and controls. Divisions utilize a set of ES&HS performance criteria and measures to assess line management performance for: (1) hazard reviews of projects and experiments; (2) work space inspection and implementation; (3) authorizations for work with radiological materials; (4) monitoring of critical ES&H training; (5) emergency preparedness; (6)

management of satellite accumulation areas; (7) documentation of disposal of hazardous, mixed and radioactive waste; (8) maintenance of chemical inventories; (9) calibration of toxic and flammable gas monitors; (10) implementation of corrective actions; and (11) quality assurance documentation for ES&H.

i. **Safety Review Committee (SRC) Review of Management of ES&H (MESH):** The SRC, composed of representatives from division research and operations, conducts triennial peer reviews of division ES&H programs. The MESH reviews are conducted by SRC members and technical experts. The review is designed to evaluate the ES&H management systems of the division. Assessment of division hazards and related controls and walkthroughs of laboratory space are conducted as part of the review. Results of the review and the division plan for corrective actions are presented to the SRC.

j. **Outside Peer Review:** EH&S subject matter experts from organizations external to the Laboratory are periodically invited to perform peer reviews of EH&S Division programs. The review is intended to evaluate the effectiveness of institutional EH&S programs to identify and control Laboratory hazards, which includes chemical and radiological vulnerabilities. The peer review results are presented to the EH&S Division Director and the Deputy Laboratory Director, Operations, for appropriate follow-up.

3. **Emergency Preparedness Programs:** Emergency preparedness and readiness at Lawrence Berkeley National Laboratory (LBNL) is maintained at a level commensurate with known hazards. The Master Emergency Plan (MEP), published in October 1993, remains the basic document for the program. Senior management - including the Laboratory Director, Deputy Directors, Division Directors, and Department Heads - are periodically briefed on the program. Senior management is committed to ensuring LBNL emergency preparedness program objectives are met.

A comprehensive drill-and-exercise program is the focus of the LBNL emergency management program. It provides for a drill/exercise design committee to be chaired by the General Science and Operations Support Group Leader/Emergency Manager and includes training for controllers and evaluators. Safety Analysis Documents and other reputable hazard analysis documents are used to establish credible scenarios which mandate the drill and exercise program. For example, it is well known that LBNL is vulnerable to earthquakes and urban–wildland fires, based on experience and LBNL's location. To plan for earthquakes, LBNL uses planning scenarios based on the California Department of Conservation, Division of Mines and Geology Publication 78, *Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area* (1987). Emergency planning for the urban–wildland fire threat is based on a report by Applied Protection Systems, *Lawrence Berkeley Laboratory Evacuation*

and Analysis (September 30, 1992). This report evaluates the wildland-fire threat to the Laboratory and makes specific recommendations regarding planning and evacuation. Based on credible scenarios, the Emergency Command Center (ECC)Team participated in a wildland fire table top exercise in May, 1997. Also, all lab employees participated in a Lab-wide earthquake drill which included evacuation of all buildings. Development of drill scenarios for chemical and radiological hazards is based on an analysis of the work and the defined hazards. An example of the results of this process is the emergency drill conducted at the Hazardous Waste Handling Facility, October 15, 1997. This drill was based on an analysis of credible scenarios resulting from coring drums to characterize waste. Participants in the drill included the LBNL emergency responders and the Berkeley Fire Department as well as the off site treatment facility, Alta Bates Medical Center.

LBNL drills include specific activities, such as

- •notification
- •emergency communication
- •fire
- •medical emergencies
- •hazardous material detection and monitoring
- •environmental sampling and analyses
- •security
- •personnel accountability
- •evacuation
- •emergency categorization
- •decontamination
- •facility activation
- •public information
- •health physics

Exercises are comprehensive performance tests of the integrated capability of most aspects of the emergency management program associated with the Laboratory. LBNL exercises test the adequacy and effectiveness of:

- organizational command and control
- implementation procedures
- notifications and communications networks
- emergency equipment
- response organization personnel performance
- overall emergency response program performance

Exercises must be designed and conducted for maximum realism and must attempt to duplicate the sense of stress inherent to an actual emergency situation.

Coordination between LBNL emergency planners and state and local government continues to be effective. Through formal organizations such as the California Emergency Services Association, the Alameda County Emergency Managers' Association, and the Hills Emergency Forum, LBNL has established itself as an integral partner in regional emergency management programs.

4. Lessons Learned

Lessons learned from events that occur on- and off-site are disseminated to Laboratory employees. On-site lesson learned sources include events that occur in laboratory and shop areas, injury and ORPs. The DOE Lessons Learned List Server is a useful source of information for events that occur throughout the DOE complex. Posted items are reviewed by the EH&S lessons learned coordinator. Relevant issues are forwarded to EH&S division program managers, tech leads and subject matter experts for distribution to appropriate Laboratory personnel or for inclusion in training programs. Items that are distributed in this manner are tracked in a log. Examples of how lessons learned are disseminated are presented below:

- A review of the Laboratory's injury and illness records indicated that injury rates associated with back safety in was an area that needed attention. A Behavioral Based Accident Prevention (BBAP) program was developed and implemented in one of the Departments that had high frequency and severity rates. This is a peer oriented program that focuses on changing unsafe behaviors. Coaching sessions between employees identify and change unsafe behaviors (such as improper lifting techniques). This program has been well received by LBNL employees and have helped to reduce the number of back safety related injuries.

- As a result of the organo-mercury poisoning incident that occurred at Dartmouth University (an event that was posted on the DOE Lessons Learned List Server). EH&S industrial hygienists searched the Laboratory's chemical inventory and identified locations where the organo-mercury compounds were used. Employees in these locations were briefed on the Dartmouth incident, the hazards of organo-mercury compounds, symptoms of exposure and appropriate controls. Special emphasis was placed on the selection of personal protective equipment, especially chemically resistant gloves.

- A laboratory researcher was contaminated with radioactive P-32. The causes of this occurrence were identified as personnel error and a lack of adequate definition, dissemination and enforcement of policy. The corrective actions resulting from this event included: retraining of the subject research group, review of roles and responsibilities with all personnel at a Division-wide meeting and enhancement of material transportation controls.

5. Training: Requirements for Chemical and Radiation Workers

a. Chemical Safety Program: The chemical safety training elements are designed to be sufficient so that employees are "apprised of the hazards of chemicals present in their work areas," and are provided at the initial assignment of an employee to a work area and upon changes to that

assignment involving new exposure situations. These elements include: methods and observations to detect the presence/release of a hazardous chemical; physical and health hazards of chemicals; measures of protection for employees; training on content of a written program; as well as, location and availability of reference.

The training provided by EH&S is complemented by hands-on line management on-the-job training. Training offered by EH&S is periodically updated to meet the needs of those attending classroom sessions or taking EH&S-sponsored challenge exams. EH&S has attempted to make this required material more germane to the hazards and tasks at hand; one prime example of this is the EH&S facilitated challenge exam, whereby Laboratory staff conducting similar research (e.g., biomedical-type research) are provided a targeted orientation on chemical safety prior to being administered a exam that test their knowledge of chemical safety considerations and hazards they might typically encounter in their work areas. On-the-job training attempts to address the safe conduct of specific laboratory procedures and use of experimental equipment, and is generally performed in a much less formal way than EH&S training.

b. **Radiation Safety Program:** An integral part of the Radiation Protection Program is assurance of appropriate training with respect to safe handling of radioisotopes and related material. Individuals operating under an RWA are required to complete a radiation fundamentals course along with a specific course on safe use of radioisotopes in the laboratory, including mitigation of radioactive contamination. Annually, all staff covered by a Work Authorization are given a briefing (re-training) on safety considerations specific to their use of radioisotopes, and appropriate re-training topics are identified for future follow-up.

c. **Training Program:** The EH&S training program provides a framework to assist line management to fulfill its responsibilities in assuring that all staff are trained commensurate with the hazards that they encounter in the course of their work. The Job Hazard Questionnaire (JHQ) is a tool that allows for supervisor-employee interaction in identifying those pertinent hazards and accordingly those specific EH&S training courses (including radiation and chemical safety) that relate to the work being performed. Line management verifies accuracy of the content of the JHQ and periodically monitors, at a minimum annually through the P2R process, the progress of completed coursework by applicable staff. In addition, institutional self-assessment initiatives and UC/DOE Performance Measures target training completion rates to help establish program effectiveness and provide feedback to EH&S and line management regarding continuous improvement.

ENCLOSURE (2) 12/16/97

Chemical Vulnerabilities of Facilities in Transition

1. Work Planning: Projects that involve construction, demolition, decommissioning and decontamination are evaluated by the EH&S Division. In cases where the project requires preplanning and design reviews, EH&S representatives are involved in these early stages. A work plan is generated and reviewed by EH&S. The smaller projects are discussed in the weekly Project Coordination Meetings conducted by the Facilities Department. An EH&S representative is always in attendance.

2. Hazard and Risk Analysis: Each project is evaluated for potential hazards and, if warranted, a work permit will be issued with the controls prescribed. At the inception, the work permit program was directed at radiological concerns but we recognized that before permitting facilities' workers into a laboratory environment, we had to evaluate all safety issues. The permit program addresses hazardous chemicals, asbestos, lead, confined space, electrical hazards, and occupational safety. We work closely with the other disciplines within EH&S for their review and input.

A training program to prepare facilities' personnel to work in a radioactive materials area is in place but is being improved to include "Hazards Recognition." All phases of safety will be presented with the emphasis on each employee having the capability to recognize hazards. Before work begins on a particular project, a pre-job briefing is held with all authorized workers to discuss each line item on the permit and any job-specific concerns.

3. Establishment of Controls: Controls are established in the Work Permit. The controls include training, protective clothing and equipment, air sampling, EH&S surveillance, signage, and instrumentation. Recently, an additional review was implemented to address emergency response. The LBNL Fire Department and their HazMat specialist review all work permits. This informs the emergency responders about the hazards that they may encounter. If the hazard level is severe, an emergency response review and even an exercise may be designated. In addition, a " HazMat Alert" will be sent to the Fire Department if a process that is already permitted goes into a particularly hazardous phase. They, in turn, will prepare for an emergency by whatever means they deem necessary to ensure the safest and quickest response. This could include not scheduling any off site responses to actually positioning a team at the scene.

4. Work Performance: When all of the terms and conditions specified in the Work Permit are satisfied and the pre-job briefing is completed, the authorized personnel are permitted to begin work. Adherence to the work plan is monitored throughout the project. Inspections are conducted to ensure compliance. Examples of the most recent projects:

Building 70, Pitroom Project
Buildings 70/70A Ventilation Project
Demolition & Decommissioning 62-248 &250
Bldg 66 Fume Hood Replacement Project
Closure of 75 Complex
Demolition & Decommissioning 74B

A table of Chemical Vulnerability of Facilities in Transition is attached which provides specific details for the above projects.

CHEMICAL VULNERABILITY OF FACILITIES IN TRANSITION

TERM	TITLE	SCOPE	POTENTIAL HAZARD	STATUS
1/93 to 6/95	70/70A Ventilation Project	Upgrade glove box fume hood exhaust systems in buildings 70 & 70A. New blowers, new ductwork, & fire suppression systems.	Radioactive Contamination • Transuranics Asbestos Peroxides Deposits Perchlorate Deposits	Project Completed All Potential Hazards Addressed & Mitigated All wastes transported to TSDF under existing waste acceptance criteria.
8/94 to 2/95	D & D Building 62-248 & 250	Decommission & decontaminate rooms 248 & 250. Remove all fixtures - strip rooms. Transfer equipment to campus.	Radioactive Contamination Chemical Inventory Asbestos Organic Solvents Acids	Project Completed All Potential Hazards Addressed & Mitigated All wastes transported to TSDF under existing waste acceptance criteria.
4/95 to 2/96	Fume Hood Replacement Project	Replace fume hoods in buildings 70, 70A, 26, 74, 88, & 75	Radioactive Contamination Acids - HNO_3, HCl, H_2SO_4, HF Organic Solvents Peroxide Deposits	Project Completed All Potential Hazards Addressed & Mitigated All wastes transported to TSDF under existing waste acceptance criteria.
4/95 to 5/96	74B Demolition Project	Building 74B to be demolished to be replaced with Human Genome	Radioactive Contamination • Transuranics • C-14 Biohazards Organic Solvents Acids Peroxide Deposits Perchlorate Deposits	Project Completed All Potential Hazards Addressed & Mitigated All wastes transported to TSDF under existing waste acceptance criteria.

TERM	TITLE	SCOPE	POTENTIAL HAZARD	STATUS
9/95 to 9/30/98 projected	Pitroom Reorganization Project	Reorganize, characterize and repackage radioactive materials stored in Pitroom, 70-147A	Radioactive Contamination Radiation Exposure Organic Solvents Acids Unknowns Confined Space Lead Asbestos	Projected completion date - 9/30/98 Radiation surveys conducted before, during, and after work with radioisotopes. TLDs and baseline bioassays required for all workers. "Real time" air sampling in breathing zone. All personnel received Confined Space training. Lead and asbestos evaluations performed before work was begun. Tests conducted for perchlorates & peroxides. All work performed in a fume hood or HEPA filtered glove box. Conduct r-spectroscopic analysis prior to opening primary containers. Waste streams characterized for disposal under waste acceptance criteria.
8/96 to 1/98 projected	HWHF, 75 Complex	Decommissioning & decontamination of Hazardous Waste Handling Facility for closure.	Radioactive Contamination • Transuranics • Tritium • Various other Nuclides Chemical Contamination • Acids • Bases • Organics Asbestos Lead	Projected completion date - 1/2/98 Radiation surveys and swipes conducted before, during and after all work in "Controlled Area". Lead and asbestos evaluations were conducted before work was begun. Tests conducted for perchlorates and peroxides. Surveys for possible chemical contamination are being analyzed for characterization. Waste streams characterized for disposal under waste acceptance criteria.

ENVIRONMENT, HEALTH
& SAFETY DIVISION

December 10, 1997
DIR-98-34

TO: Richard Nolan
DOE Site Office

FROM: David McGraw, Director
Environment, Health & Safety Division

SUBJECT: Management of Chemical Hazards

Please find enclosed the first submission in response to Dr. James Turner's request for information as part of the report to Secretary Peña assessing chemical and radiological vulnerabilities. The initial request for information assessing chemical and radiological vulnerabilities due November 18, 1997, is attached. The complete response to Secretary Peña's letter of August 4, 1997 will be submitted to you by the mid-December due date.

The complete response will include a description of the Berkeley Lab's program for assessing facility and operational vulnerabilities on an on-going basis, including training and technical competence and the Lessons Learned Program. An additional document will describe this Lab's management and resolution of previously identified chemical and radiological vulnerabilities at facilities and operations either shut down or undergoing change over to another mode of operations.

DCM:ep

Attachment

c: J. Bartley
J. Chung
L. McLouth
J. Salazar
D. Tudor

ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY
UNIVERSITY OF CALIFORNIA | BERKELEY, CALIFORNIA 94720
TEL: 510.486.5514 | FAX: 510.486.7488

CHEMICAL VULNERABILITY ASSESSMENT

Review of Current Vulnerabilities
E.O. LAWRENCE NATIONAL LABORATORY
November, 1997

Background

In response to the letter from Secretary Pen'a, dated August 4, 1997 (Attachment A), Dr. James Turner, letter dated August 18, 1997, requested Director Shank to submit the preliminary results of an assessment of potential chemical vulnerabilities at Berkeley Laboratory by November 18, 1997. This preliminary report is enclosed. Information to meet this objective was collected by means of a comprehensive assessment of current chemical vulnerabilities with respect to Berkeley Laboratory operations. The purpose of this effort was to meet the request from the Secretary to evaluate the "use, storage, and disposal of any chemicals with the potential for explosion, fire, or significant toxic release" at physical locations within Berkeley Laboratory. The other requested assessment reports (assessment of the overall program for controlling chemical vulnerabilities and an assessment of decommissioning of inactive facilities) requested in Dr. Turner's letter are in preparation and will be submitted, along with the final version of the attached report, prior to the December 15, 1997 deadline.

Areas reviewed for assessment of potential chemical vulnerabilities were selected based on concerns raised by any one of the following sets of information:

1. Personal knowledge of an integrated team of EH&S professional staff representing all the professional fields in ES & H and all programmatic areas;
2. Lists of chemical accumulations areas such as waste accumulation (WAA) or other chemical and flammable liquid accumulation areas; and
3. Reviews of relevant ES&H documentation; e.g., chemical inventory, previous hazard assessment (IFA data), Safety Analysis Documents, and Readiness Reviews.

Those candidate areas deemed to be of significant concern or for which additional information was needed were evaluated via field walk-throughs by the Berkeley Laboratory fire protection program lead (T. Yuen, P.E.) and a certified industrial hygienist (J. Salazar).

E.O. Lawrence Berkeley National Laboratory
Chemicals and Flammable Liquids Accumulation Areas

Bldg. No.	Location	Use	Potential Hazards	Fire Detection	Fire Suppression	Fire Resistive Construction	Spill Containment	Remarks	Current Vulnerabilities	Vulnerabilities Addressed
2 A	101	Flam. Liqs. Storage	Flammable Liquids/Chemicals	Heat Detector	Auto Sprinkler	2 hour rated	Yes	This is a central storage area for users in Bldg. 2. flammable liquids (about 25 gallons) , oxidizers and other chemicals.	None	Not Applicable
2 A	102	Gas Storage	Flammable Gases and Oxidizer Gases	Heat Detector	Auto Sprinkler	2 hour rated with explosion venting	Yes	This is a central storage area for users in Bldg. 2. Flammable gases and oxygen separated by the fire rated partition cut off the line of sight. ***Found oxygen cylinder left in area where it was not designated for oxygen storage. RECOMMENDATIONS: Relocate cylinders to their designated area and provide additional training to users.***	Low	Yes
3	Rooftop	WAA	Flammable Liquids/ Carcinogen	Heat Detector	Auto Sprinkler	None	Yes	***Flam. liquids were stored outside of cabinets due to relocation of researchers.*** ***RECOMMENDATIONS: Flammable liquids were relocated and stored in an approved location. Need better administrative control and training of the users.***	Low	Yes
3	163	Laboratory	Toxic Gases	Heat Detector	Auto Sprinkler	None	Ventilated Enclosure	Boron Trichloride and boron trifluoride in lecture bottles are used. They are used inside a ventilated hood.	None	Not Applicable
10	100	Central Gas Storage for ALS	Toxic Gases, Corrosive Gases and Flammable Gases	None	Auto Sprinkler	1 hour rated	Gas Cabinets	This is a central gas storage area for the ALS. Gases are segregated for incompatibilities and stored in one of the 4 gas cabinets. Most of the bottles inside the gas cabinets are lecture size bottles.	None	Not Applicable
10	104	Storage & Dispensing	Flammable Liquids and Corrosives	None	Auto Sprinkler	1 hour rated	Yes	Flammable Liquid Cabinets and Acid cabinets are provided. Containers are grounded and bonded electrically.	None	Not Applicable
25	West of Bldg	WAA	Toxic Wastes from Waste Treatment Unit	Heat Detector	Auto Sprinkler	None	Yes	It houses fluoboric acid, hydrogen peroxide, and other chemicals used in the photo-masking process. The quantities are small.	None	Not Applicable
25 C1	Pre-fab Storage Locker	Chem. Stor.	Corrosives	None	None	None	Yes	Bulk (drum) storage of chemicals for use in the Photo Fabrication Shop.	None	Not Applicable
25 C2	Pre-fab Storage Locker	Chem. Stor.	Caustics	None	None	None	Yes	Bulk (drum) storage of chemicals for use in the Photo Fabrication Shop.	None	Not Applicable
25 C3	Pre-fab Storage Locker	Chem. Stor.	Oxidizers	None	None	None	Yes	Bulk (drum) storage of chemicals for use in the Photo Fabrication Shop.	None	Not Applicable

Legend: WAA = waste accumulation area, Dry Chem = dry chemical extinguishing system
Note: All heat detectors and fire suppression systems are electronically monitored at the on-site fire department.

E.O. Lawrence Berkeley National Laboratory
Chemicals and Flammable Liquids Accumulation Areas

Bldg. No.	Location	Use	Potential Hazards	Fire Detection	Fire Suppression	Fire Resistive Construction	Spill Containment	Remarks	Current Vulnerabilities	Vulnerabilities Addressed
27	Cargo Container	WAA	PCB small quantity	None	None	Non-rated	Yes	Used fluorescent tubes and PCB ballast from light fixtures.	None	Not Applicable
58 B	Shed	Combust Liqs Stor	Class III B- Combustible Liquids	None	None	Non-rated	Yes	This is a central area for users in Bldg. 58 to dispense transformer oil and lube oil.	None	Not Applicable
62	105	Chem. Stor.	Flammable Liquids and Corrosives	Heat Detector	Auto Sprinkler &CO2	2 hour rated	Yes	This is the central storage area for chemical and flammable liquids. Flam. cabinets are provided.	None	Yes
62 C	Pre-fab Storage Locker	WAA	Waste Oil / Organic Solvents	Fusible Link	Dry Chemical	2 hour rated	Yes	Two 55 gallon containers are used for waste oil and waste solvents.	None	Not Applicable
62 D	Pre-fab Storage Locker	Flam Stor	Flam Liqs./Lube Oil	Fusible Link	Dry Chemical	2 hour rated	Yes	Vacuum pump oils (5 gallon containers) and lubricants (55 gal drums) are stored and being dispensed in from this storage locker.	None	Not Applicable
69	Outdoors	Flam Liq. Stor.	Class I B - Flam Liq	None	Auto Sprinkler	Not Applicable	Yes	The small containers are stored in their original shipping containers and locked inside Flammable Liquids Cabinets for pick-up. Drums are stored on the drum storage rack for delivery.	None	Not Applicable
70	248	Chem. Stor.	Flammable liquids and corrosives	Heat Detector	Auto Sprinkler	2 hour rated	Yes	This is the central storage area for chemical and flammable liquids. Flammable Liquids and Corrosives Cabinets are provided for additional segregation.	None	Not Applicable
70	Lower Parking Lot	Tank	Bulk Liquid Oxygen	None	None	Not Applicable	partial	***Parking spaces are located to less than 10 feet from the tank as required by NFPA 50. Fallen leaves shall be cleaned from diked area.*** ***RECOMMENDATIONS: 1) Restrict parking to at least 10 feet from the diked area. 2) Post sign and paint a restricted area in the parking lot. 3) Clean diked area free of debris and cut back tree branches within 15 feet of the diked area.***	Low	Yes Recommendations have been forwarded to Work Request Center.
70 A	3337	Chem. Stor.	Carcinogen, Corrosives, Flammable Liquids, and Pyrophoric Solids	Heat Detector	Auto Sprinkler &CO2	2 hour rated	Yes	Open shelves storage of chemicals for one research group. Compatible chemicals are grouped in trays and stored on shelves. Various type of chemicals and solvent in small containers no larger than 5 liters each.	None	Not Applicable

Legend: WAA = waste accumulation area, Dry Chem = dry chemical extinguishing system
Note: All heat detectors and fire suppression systems are electronically monitored at the on-site fire department.

E.O. Lawrence Berkeley National Laboratory
Chemicals and Flammable Liquids Accumulation Areas

Bldg. No.	Location	Use	Potential Hazards	Fire Detection	Fire Suppression	Fire Resistive Construction	Spill Containment	Remarks	Current Vulnerabilities	Vulnerabilities Addressed
70 A	3343	Semi-conductor Fab Lab	Flam. Highly Toxic, unstable reactive (detonable), Water Reactive, and Pyrophoric Gases	Heat Detector	Auto Sprinkler	1 hour rated	Toxic Gas Alarms and Gas Cabinets	Diborane/He (1.66 c.f.), Phosphine/silane 1 % (1.66 c.f.),silane (21 c.f), Hydrogen (50 c.f) and methane(50cf) are stored in 2 gas cabinets. Room ventilation is negative compare to the surrounding areas. Refer to AHD for PECVD tools.	None	Not Applicable
70 A	4419	Perchloric Hood	Perchloric Acid	Not Applicable.	None	Not Applicable	Not Applicable	Wash down system has been provided in the hood.	None	Not Applicable
70 A	4429	Perchloric Hood	Perchloric Acid	Not Applicabl.	None	Not Applicable	Not Applicable	Wash down system has been provided in the hood.	None	Not Applicable
70 A	4457A	Semi-conductor Research Lab	Flam. Highly Toxic and Pyrophoric Gases	Heat Detector	Auto Sprinkler	1 hour rated	Toxic and Hydrogen Gas Alarms and Gas Cabinets	Hydrogen, dichlorosilane, phosphine are stored inside gas cabinets. Gas detectors and other automatic shutoff features are in place. Room where gas cabinets are located is also negative in compare to surrounding areas.	None	Not Applicable
71	253	Laser Lab	Toxic Gas	Heat Detector	Auto Sprinkler	None	Gas Cabinets	20 cu. ft of fluorine is used in this lab.	None	Not Applicable
76	Paint Shop	WAA	Flammable Liqs, Lead, Aerosol Can, etc.	Fusible Link	Dry Chemical	2 hour rated	Yes	WAA for the paint shop. It can have solvent based paint, water based paint, lead paint chips aerosol cans and centrifugal sludge.	None	Not Applicable
76	C&M	WAA	Flammable and Combustible Liquids, Acids and PCB	Fusible Link	Dry Chemical	2 hour rated	Yes	WAA For the maintenance and operations department. Waste oil, gasoline, diesel, hydrochloric acid, acetic acid and sulfuric acid are stored. Incompatible are stored in separate compartments.	None	Not Applicable
77	Outdoors	Tank	Bulk Liquid Oxygen	None	None	Not Applicable	Yes	The tank is located next to the acetylene storage and is separated from the acetylene tanks by a 2 hour fire rated wall. The oxygen tank is located in a diked area.	None	Not Applicable
77 J	Pre-fab Storage Locker	Chem. Stor.	Corrosives	Heat Detector	Dry Chemical	1 hour rated	Yes	The chemicals are being used in the High Vacuum Cleaning Facility at Building 77.	None	Not Applicable
77 K	Pre-fab Storage Locker	Chem. Stor.	Corrosives	Heat Detector	None	1 hour rated	Yes	The chemicals are being used in the High Vacuum Cleaning Facility at Building 77.	None	Not Applicable
77 L	Pre-fab Storage Locker	Chem. Stor.	Caustics(up to 4 drums of 55 gal. each)	Heat Detector	None	1 hour rated	Yes	The chemicals are being used in the High Vacuum Cleaning Facility at Building 77.	None	Not Applicable
77 M	Pre-fab Storage Locker	Chem. Stor.	Corrosives	Heat Detector	None	1 hour rated	Yes	The chemicals are being used in the High Vacuum Cleaning Facility at Building 77.	None	Not Applicable

Legend: WAA = waste accumulation area, Dry Chem = dry chemical extinguishing system
Note: All heat detectors and fire suppression systems are electronically monitored at the on-site fire department.

E.O. Lawrence Berkeley National Laboratory
Chemicals and Flammable Liquids Accumulation Areas

Bldg. No.	Location	Use	Potential Hazards	Fire Detection	Fire Suppression	Fire Resistive Construction	Spill Containment	Remarks	Current Vulnerabilities	Vulnerabilities Addressed
77 N	Pre-fab Storage Locker	Chem. Stor.	Corrosives (largest container is 55 gal drums)	Heat Detector	Dry Chemical	1 hour rated	Yes	The chemicals are being used in the High Vacuum Cleaning Facility at Building 77.	None	Not Applicable
77 Q	Pre-fab Storage Locker	WAA	Lead, flammable solvent waste	Fusible Link	Dry Chemical	2 hour rated	Yes	This is the WAA for the Bldg. 77 Paint Shop	None	Not Applicable
77 R	Pre-fab Storage Locker	WAA	Corrosives, Oxidizers & Water Reactive Wastes	Fusible Link	Dry Chemical	2 hour rated	Yes	This is the WAA for the Bldg. 77 High Vacuum Cleaning Facility	None	Not Applicable
77 S	Pre-fab Storage Locker	WAA	Flammable Liquid Wastes	Fusible Link	Dry Chemical	2 hour rated	Yes	This is the WAA for the Bldg. 77 High Vacuum Cleaning Facility	None	Not Applicable
79 A	Pre-fab Storage Locker	Flam. Liq Storage & Dispensing	Flammable Liquids and Lube Oils	Heat Detector	Auto Sprinkler	2 hour rated	Yes	For central storage and dispensing for users in the vicinity of Bldg. 79. 2-55 gal drums of acetone, 2 drums of hydraulic oil and 2 drums of isopropyl alcohol.	None	Not Applicable
85	Entire Complex	Hazardous Waste Handling Facility	Flammable Liquids, Combustible Liquids, Corrosives, Pryophorics, Oxidizers and Radioactive Wastes	Heat Detectors, Smoke Detectors	Hi-Expansion Foam, AFFF, Sprinklers, Dry Chemical	Various to 2 hour rated	Yes	Refer to the Safety Readiness Review Documentation for the Replacement Hazardous Waste Handling Facility.	None	Not Applicable
903	Warehouse	Transient	Flammable Liquids / Chemicals	None	Auto Sprinkler	Not Applicable	None	This is our central receiving warehouse. Small quantities received from vendors and to be delivered to individual user.	None	Not Applicable

Legend: WAA = waste accumulation area, Dry Chem = dry chemical extinguishing system
Note: All heat detectors and fire suppression systems are electronically monitored at the on-site fire department.

STANFORD UNIVERSITY

STANFORD LINEAR ACCELERATOR CENTER

Mail Address:
SLAC, Bin 84
P.O. Box 4349
Stanford, CA 94309
Telephone: (415) 926-3295
FAX: (415) 926-3030
Jackhahn@SLAC.Stanford.Edu

Nov. 17, 1997

Mr. John Muhlestein
DOE Stanford Site Office/Bin 08A
Stanford Linear Accelerator Center
P.O. Box 4349
Stanford, CA 94309

Subject: Management of Chemical Hazards

Dear Mr. Muhlestein:

The purpose of this letter is to respond to the DOE Oakland Operations Office letter of August 18, 1997 requesting steps be taken regarding Management of Chemical Hazards. Specifically, this document responds to the requirement for a chemical and a radiological vulnerabilities assessment and provides a complete assessment. Provided below are responses to the three specific issues identified in the letter dated October 7, 1997, from James S. Hirahana, Associate Manager for Site Management, Department of Energy, Oakland Operations Office. For each of these three issues, we have identified current program activities that are in place to control the potential problem. We have also identified additional planned activities, based on our analysis, if needed.

Sincerely,

Jack Hahn
Department Head
Safety, Health & Assurance Department
Environment, Safety & Health Division

JH:cn

Enclosure

cc: K. Kase
J. Turner
V. Stone

Issue #1 **Scrutinize the use and storage of any chemicals that have the potential for fire, explosion, or significant toxic release, and must properly dispose of unneeded chemicals in accordance with safety requirements and environmental regulations.**

Current Program Activities

Industrial Hygiene assessments are conducted by doing a periodic building walk-through. Building inspections involve surveying the chemicals in the area which includes: seeing how the chemicals are stored, determining the quantity of each chemical, and determining how frequently each chemical is used. Building inspections also look at what types of Personal Protective Equipment (PPE) are used and/or required. Other issues addressed during the building inspections and seismic safety audits include: access and egress, proper separation of chemicals, secondary containment, and security of containers.

Currently, the ES&H Division has approximately 80 employees. Department responsibilities within the ES&H Division include, but are not limited to, the following: fire safety, building safety, electrical safety, industrial hygiene issues, radiation safety, general industry safety compliance, training, Workers' Compensation, Hazardous Materials Business Plan (HMBP), SARA (Superfund Amendments and Reauthorization Act) Title III compliance and reporting, and quality assurance. Staff members have the opportunity for involvement in scrutinizing the use and other aspects of chemical management.

The laboratory does not have a significant inventory of unused chemicals as do some DOE facilities. Chemicals that are no longer being used are disposed of as hazardous waste according to EPA and Cal/OSHA regulations. The regulations are 40 CFR 261 to 264 and CCR Title 22 for EPA and Cal/OSHA, respectively. If a chemical is in excess and is no longer being used by that group, the chemical may then be used by another group.

For radiological materials, analysis of operations indicates no potential for "significant toxic release" or other problems as defined in this issue. The Operational Health Physics (OHP) Department at SLAC manages the radiological concerns and ensures compliance with all federal, state, and local regulations.

Additional Planned Activities

Shock sensitive chemicals may be found in the Plating Shop, SSRL, and Central Lab. The Safety, Health and Assurance Department plans to issue a safety bulletin regarding shock sensitive chemicals. This bulletin will be issued within three months (by February 1998).

Issue #2 **Evaluate the facility and operation for new vulnerabilities on a continuing basis.**

Current Activities

Purchase requisitions are coordinated and reviewed by a Safety Engineer and/or an Industrial Hygienist. Other experts are called upon when needed.

Chemical usage is monitored annually through the Hazardous Materials Business Plan (HMBP). Another annual report is the Emergency Planning and Community Right-To-Know Act, SARA (Superfund Amendments and Reauthorization Act) Title III. Material Safety Data Sheets (MSDS) are also available at the site where the chemicals are located and being used. Also, MSDSs are accessible via the Internet.

Radiological hazards are handled by the Operational Health Physics (OHP) and Radiation Physics (RP) Departments of ES&H. OHP reviews purchase requisitions for radiological materials and controls the movement of sources. RP assesses beam shielding controls due to changes in beamline operations and other radiological processes.

Additional Planned Activities

A program will be implemented within six months to expand and formalize the current review program. This program will address the substitution of chemicals to ensure that safer and less toxic chemicals are used, and implement chemical process reviews in terms of safety labeling and chemical usage. Process reviews may include: inspecting the standard operating procedures, determining chemical hazards, determining what types of safeguards are on the equipment to avoid release into the atmosphere, and what type of emergency equipment is necessary.

Issue #3 **Assess the technical competence of its staff to recognize the full range of hazards presented by the materials in the facility and implement training programs where needed.**

Current Program Activities

SLAC provides Hazard Communication General Training, Course 103 and Hazard Communication Supervisor Training, Course 101. Additional courses are available such as: Introduction to Pollution Prevention and Hazardous Waste and Materials Management, Course 105; Hazardous Materials Transportation Training, Course 259; Hazardous Waste and Materials Coordinator (HWMC) Annual Refresher Training, Course 224.

SLAC's HAZCOM Training program does have two elements, one for Technicians and one for Supervisors. SLAC does have a refresher course for the Hazard Communication General Training.

Most laboratories at SLAC are supervised by generally well-trained M.S. or Ph.D. che. .ists.

All visitors, users, subcontractors, and employees who are at SLAC for more than thirty days, and are expected to receive a dose less than 100 millirems of radiation per year, must attend the General Employee Radiological Training (GERT), Course 115.

SLAC employees that are expected to receive a dose of greater than, or equal to, 100 millirems of radiation per hour and not to exceed 1500 millirems of radiation per year are required to take Radiation Worker Training.

Additional Planned Activities

None required.

Boeing North American, Inc.
Rocketdyne Division
Energy Technology Engineering Center
Boeing Defense & Space Group
P.O. Box 7930
Canoga Park, CA 91309-7930

October 1, 1997
In reply refer to 97ETEC-DRF-97-0373

BOEING

James M. Turner, Ph. D.
Manager, Oakland Operations Office
US Department of Energy
1301 Clay Street
Oakland, CA 94612-5208

Subject: **Management of Chemical Hazards**

Reference: 1) Letter, James M. Turner , Ph.D. to Mark Gabler, same subject, dated August 18, 1997 (97ETEC-DRF-0291)

2) Letter, W. S. De Bear to Hannibal Joma, " Chemical Explosion at Hanford", dated June 18, 1997 (97ETEC-DRF-0184)

Dear Dr. Turner:

Reference 1 transmitted the Accident Investigation Board Report on the May 14, 1997 explosion in the Hanford Plutonium Reclamation Facility, and directed that all DOE field elements and site contractors assess their management of chemical and radiological hazards. Reference 2, prepared following ETEC's review of the May 22, 1997 Safety Alert concerning this accident, provided a partial response prior to the present request and concluded that no similar circumstance, with potential for significant energy or toxic material release, currently exists at ETEC. However, in light of this more thorough present review, one circumstance, i.e., the interim storage of sodium-wetted components pending cleaning, was identified as having the potential for hydrogen generation and container overpressurization. Although these containers routinely are monitored for any sign of bulging or deterioration, breather valves are on order and will be installed to preclude any possibility of significant pressure buildup. Additional discussion in this area, and ETEC's responses to the other concerns requiring assessment, are provided in the attachment.

Please contact me, or W. S. De Bear at (818)586-5942, if there are questions or further discussion is required on any of the assessment items.

Very truly yours,

M. J. Gabler, Director and Program Manager
Energy Technology Engineering Center

cc: P. Boehme, ESO
H. Joma, Manager, ESO

1. Use, storage, and disposal of any chemicals with potential for explosion, fire, or significant toxic release:

   The chemicals that are, or have been, present at ETEC in sufficient quantity to represent potential threats of the types listed above are ammonia, sodium, and ethanol.

   Ammonia (both anhydrous and aqueous):

   Ammonia, which is classified as an extremely hazardous material, was present, in quantity, during operation of the Kalina Demonstration Plant. Following Kalina shutdown, in October, 1996, all ammonia was removed. Consequently, there is no present potential for a release and there are no current plans for restoring the ammonia inventory or resumption of operation .

   Sodium:

   ETEC's two largest test facilities, i.e., the Sodium Pump Test Facility (SPTF) and the Steam Generator Test Facility (SCTI), each contain over 30,000 gallons of sodium. The Liquid Metal Development Laboratory-2 (LMDL-2) contains two small test rigs which, together, contain approximately 100 gallons of sodium. The two large facilities currently are inactive, with solidified sodium in the storage tanks, under a positive pressure, inert gas cover. The probability of a sodium leak or fire under these conditions is essentially zero.

   One of the test rigs in LMDL-2 is being activated for a short-term test program and will operate at low pressure with a sodium temperature of 1200F. Although the probability of a leak is higher than in the inactive facilities, it remains very low and, considering that the quantity of sodium involved is less than fifty (50) gallons, the worst case scenario would not result in a significant off-site consequence.

   SPTF is scheduled to resume operation in CY 1999 to test a large electromagnetic pump. At that time the sodium system will be heated and filled, and sodium circulation will be resumed. Maximum pressure and temperature, respectively, will be 50 psig and 1000F. Based on extensive experience with large sodium facilities operating under similar conditions, sodium leaks are possible; however, most would be small (through intergranular cracks caused by stress corrosion) and would not pose an off-site hazard. (The largest sodium leak ever experienced at SPTF occurred at an average rate of less than one gpm, involved less than 50 gallons of sodium, and did not have any appreciable impact at the site boundary.) Further, to minimize the probability of a leak during testing, a comprehensive inspection of susceptible piping and instrumentation locations will be performed prior to startup to verify pressure boundary integrity. The facility also has emergency drain capability to terminate leakage by lowering sodium level below the leak location, and an installed dry powder distribution system for suppression of external sodium reactions.

SCTI is scheduled for demolition starting in CY 1998 and most of its sodium inventory will be off-loaded and shipped for reuse. Off-loading will necessitate heating drain tanks and interconnecting piping to slightly above the melting point of sodium (208F). The tanks will then be slightly pressurized to transfer the inventory to DOT-approved isotankers. Transferred sodium then will be cooled and solidified before the isotankers are permitted to move on-site (some of the sodium will be used to increase the inventory at SPTF) or to leave the SSFL site. The potential for significant leakage or off-site impacts during these processes is considered negligible.

Bulk sodium from ETEC's other sodium facilities, which currently are undergoing demolition, has already been removed and shipped off-site for reuse. A small amount of residual sodium remains in piping segments and removed components pending its conversion to sodium hydroxide and reuse as product. This conversion is being done, predominantly, using a Water Vapor/Nitrogen (WVN) process which results in a slow, controlled reaction and produces usable, high concentration caustic. The WVN process does result in the production of hydrogen. Hydrogen concentration within the WVN system (in nitrogen with essentially 0% oxygen) is closely monitored and normally is between 1 and 2%; however, during occasional excursions, it briefly can exceed 20%. For this reason, the effluent gas is continuously diluted such that the hydrogen concentration in air always is maintained well below the lower explosive limit (LEL) of 4%. A small fraction of the residual sodium, in components which are not suitable for cleaning by WVN, will be treated at ETEC's Hazardous Waste Management Facility (HWMF). HWMF is a Permitted facility, with limited treatment capability and numerous safeguards to preclude any significant on-site or off-site consequences. Both of these treatment options are considered to be safe and effective; however, a potential concern does exist during storage of sodium-wetted components pending treatment. Although many of the components have had closures welded over their cut ends to prevent entry of moisture, in some cases welded closures are not possible. These components are stored, indoors, in drums or boxes which, though sealed, conceivably could permit the incursion of moisture and subsequent pressurization from the generation of hydrogen. To alleviate this concern, all such drums and boxes are visually monitored for any sign of bulging, damage or deterioration and their conditions, and any pertinent observations, are logged at least once per week. As an added precaution, breather valves have been ordered and will be installed when received. These valves will open to relieve pressure should internal pressure exceed atmospheric pressure by 0.5 psi.

In summary, none of the operations at ETEC involving sodium, sodium conversion, or the removal and transport of metallic sodium or sodium hydroxide is considered to pose any threat of the types listed above.

Ethanol:

Denatured ethanol is used at the Component Handling and Cleaning Facility (CHCF) as a cleaning agent to slowly react and remove metallic sodium from large, sodium-wetted components such as steam generators and the pumps tested in SPTF. The storage tank(s) at CHCF normally hold approximately 20,000 gallons of ethanol.

These tanks recently were emptied of previously used ethanol to permit removal of residual sodium alcoholate reaction products but will be refilled to support future cleaning needs. The fire potential of this large quantity of ethanol is mitigated by the use of an inert (nitrogen) cover gas and by a water deluge system that provides complete coverage for the storage tanks. As an additional precaution, fire department personnel, with fire-suppression foaming equipment, are on stand-by at the site whenever ethanol transfers or cleaning operations are initiated. Berms are provided around the ethanol system to retain any leakage and maximize the effectiveness of the foaming equipment or deluge system, and the bermed areas are drained to a large overflow retention basin to prevent contamination of other on-site water retention ponds.

Radiological Considerations:

Potential radiological vulnerabilities are associated with: 1) stored TRU waste pending disposition by DOE, 2) radiological releases during Demolition & Decontamination (D&D), 3) Radioactive Materials Handling Facility (RMHF) water management operations, and 4) shipment of radioactive (RA) waste to off-site disposal facilities. Normal safeguards include: a highly trained staff, on-site fire protection personnel and facility fire protection systems, the absence of any significant source of combustion or explosion, and the performance of all operations to approved, written procedures which include all appropriate safety provisions.

All TRU waste is stored at RMHF in HEPA-filtered, below-grade, shielded vaults for ALARA and SNM control purposes. TRU waste packaged in final form for disposal incorporates vents in the container lids to preclude buildup of any gas pressure. Waste, pending final form packaging, is packaged to ensure full containment while allowing for release of any gases even though none of the waste (non-pyrophoric metallic debris from hot cell drain lines) contains any significant source of gas generation.

All D&D activities at facilities involving radioactivity are performed under the strict surveillance of Rocketdyne health physicists. Radiological risks at facilities currently undergoing D&D are extremely low due to the very low levels of radioactivity being handled. D&D is limited, almost exclusively, to basic construction materials (concrete, steel, sheet metal). No pyrophoric and almost no flammable materials are being handled.

The RMHF handles moderate amounts of radioactive waste water (<10,000 gal. total capacity) which is evaporated. The remaining sludge is solidified and packaged for disposal. Activity levels in both water and sludge are low and easily managed. The evaporator water handling system utilizes double containment throughout and no sources of ignition or combustible materials are present.

All RA waste shipped off-site for disposal conforms to Department of Transportation (DOT) 49CFR regulations and DOE approved disposal site packaging criteria. 49CFR stipulates packaging requirements appropriate to the level of hazard associated with each category of radioactive material. Rocketdyne makes all

shipments of RA waste, except "limited quantity" shipments, under 49CFR "exclusive use" provisions. All RA waste currently being disposed of is in low hazard categories (Low Specific Activity, Surface Contaminated Objects, Limited Quantities). Shipments in these categories are made in DOT "strong tight containers" as stipulated by 49CFR. The largest quantity of waste shipped (contaminated soil) contains RA levels below that regulated by DOT. However, the soil is shipped in DOT "strong tight containers" and under the direction of DOE is disposed of as RA waste at DOE approved disposal sites since it does contain detectable quantities of "DOE added RA material." A few shipments during the past year have included small quantities of waste requiring Type A packages (Radioactive Material NOS). In all cases, packages and accompanying documentation have been reviewed and verified to be free of incompatible wastes.

Future shipments of TRU waste to WIPP will utilize the TRUPACK II packaging system which was specifically designed by DOE and approved by NRC for the shipment and protection of TRU material and takes into account all credible accident scenarios.

2. The management and resolution of previously identified chemical and radiological vulnerabilities at facilities that are shut down, in standby, being deactivated, or have changed their conventional modes of operation in the last several years:

   Responses pertinent to this section are contained in the discussion under item 1.

3. Programs to assess facility and operational vulnerabilities on a continuing basis:

   ETEC has in-place a number of programs designed to assess (and correct) facility and operational vulnerabilities. The first of these, used at the start of new programs and operations, is a "Won't Fail" evaluation performed by a panel consisting of all affected disciplines. Alternative approaches for 'design' of the facility, test, or operation, are suggested and evaluated with respect to vulnerabilities and the probability of first-time-through success. After consensus is reached on the most promising approach, the panel then attempts to identify and rectify any residual weaknesses that could lead to failure. Prior to the start of operation of a new or modified facility or new test program, a Readiness Review is held to verify that construction is complete, that there are no outstanding nonconformances, appropriate procedures are in place, training of operating personnel is comprehensive and completed, and all other requirements have been met. Both "Won't Fail" and Readiness Review processes are documented.

   In addition to the above, ETEC uses the DOE Occurrence Reporting (OR) system to document problems and to identify root cause and corrective actions to prevent recurrence. The DOE OR is supplemented by an internal Corrective Action Report (CAR) which is reviewed by ETEC's Corrective Action Board (CAB) consisting of the ETEC Director and Program Manager and all direct reports, with the added participation of experts from other affected organizations. Significant events, and those with generic implications are referred to the higher level Advanced Programs CAB and, if appropriate, to the Rocketdyne Senior Management Review Board.

4. The training and technical competence of staffs to identify the full range of hazards presented by facilities, act on results and implement training programs where needed:

   All facility and support personnel are trained appropriate to their assignments. Operating personnel receive extensive, universally applicable training, e.g., Lockout/Tagout, Confined Space Entry, Lifting and Handling, Fall Protection, MSDS Awareness, etc. All persons whose assignments entail work with liquid metals, radioactivity, or specific hazardous materials (e.g., lead and asbestos) receive appropriate training on handling and safety practices. Selected personnel receive even more specialized training on handling of hazardous waste (HAZWOPER) and packaging and shipping of hazardous and RA wastes (49CFR). Most training is presented by qualified Rocketdyne instructors from SHEA, Technical and Skills Development, Quality Assurance, and Fire Protection; however, commercial training organizations (and sometimes regulatory agency experts) are utilized when necessary to obtain more comprehensive, up to date instruction.

5. The completeness and accuracy of Lessons Learned and Occurrence Reporting program efforts, the timeliness of information distribution, and appropriate action and tracking:

   ETEC makes use of multiple systems to report and evaluate internal problems and disseminate lessons learned These include not only the formal DOE OR and Rocketdyne's multi-level CAB processes, but also daily tailgate meetings, safety and lessons-learned presentations at weekly staff meetings, and ad hoc "all-hands" meetings to review events of particular significance. The "all-hands" meetings are intended - and have proven successful - not only as forums to convey information but to obtain enthusiastic participation and constructive input from all levels of the organization.

   Both formal reporting systems (DOE OR and Rocketdyne CAR) include mechanisms for tracking the timeliness of responses and corrective actions. In a number of instances ETEC responses have not met established submittal criteria; however, whenever a personal health or safety, or an environmental issue has been involved, immediate corrective action has been taken or a stand-down condition has been maintained pending completion of corrective actions.

   Other sources of information are used to learn of, and disseminate in timely fashion, applicable lessons-learned from problems experienced elsewhere. The Operating Experience Weekly Summaries issued by the DOE Office of Nuclear and Facility Safety, and Safety Alerts are widely reviewed for applicable information which then is passed along to, and discussed, with affected personnel. (ETEC prepared the earlier vulnerability assessment of reference 2 based on the Safety Alert issued following the Hanford explosion.) Internally, a separate Santa Susana Field Laboratory (SSFL) Corrective Action Board has been established to assure that the root causes and corrective actions for problems experienced by all field laboratory organizations are adequately conveyed. Also, SSFL has a Joint Employee-Management Safety (JEMS) Committee which meets regularly to discuss safety

issues, identify areas needing attention, and follow-up on corrective actions. The JEMS Committee publishes a regular newsletter to heighten employee awareness of potential safety problems and promote world-class safety behavior. Finally, Rocketdyne has adopted, and is actively utilizing, DuPont's " Safety Training Observation Program" (STOP) to record and report safety-related observations across the division, providing a mechanism for the identification and correction of safety issues.